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ABSTRACT

This student guide, one of a series of correspondence training courses designed to improve the job performance of members of the Marine Corps, contains three study units dealing with the skills needed by individuals responsible for the installation, operation, and maintenance of diesel engine-driven generator sets. The first two units cover installing, operating, maintaining, and keeping maintenance records concerning 700 series and Department of Defense series generators. The third unit is devoted to safety precautions and first aid treatment. Each unit contains a general objective, a series of work units each addressing a different subobjective, study questions, and answers to the study questions. (MN)

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**INSTALLATION , OPERATION ,
AND OPERATOR'S MAINTENANCE OF
DIESEL-ENGINE-DRIVEN GENERATOR SETS**

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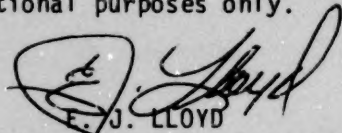
11.19c

1. PURPOSE

This publication has been prepared by the Marine Corps Institute for use with MCI course, Installation, Operation, and Operator's Maintenance of Diesel-Engine-Driven Generator Sets.

2. APPLICABILITY

This manual is for instructional purposes only.


F. J. LLOYD
Lieutenant Colonel, USMC
Deputy Director

PREFACE

INSTALLATION, OPERATION, AND OPERATOR'S MAINTENANCE OF DIESEL-ENGINE-DRIVEN GENERATOR SETS is designed to enable Marines, in any MOS and of any rank, to operate and maintain the current family of generator sets.

SOURCE MATERIALS

TM 07464A-12
TM 6115-15/2

Generator Set, Diesel Engine Driven, Tactical, Jun 1973
Generator Set (DED), PU-708/G and PU-709/G Apr 1969 w/ch
1 Jun 1971

INSTALLATION, OPERATION, AND OPERATOR'S MAINTENANCE OF DIESEL-ENGINE DRIVEN GENERATOR SETS.

Course Introduction

INSTALLATION, OPERATION, AND OPERATOR'S MAINTENANCE OF DIESEL-ENGINE-DRIVEN GENERATOR SETS is designed to provide the Marine with the required knowledge to install, operate, and perform organizational maintenance on mobile electric power systems currently used by the Marine Corps.

ADMINISTRATIVE INFORMATION

ORDER OF STUDIES

<u>Study Unit Number</u>	<u>Study Hours</u>	<u>Subject Matter</u>
1	3	700 Series Generators
2	3	DOD Series Generators
3	3	Safety
	2	REVIEW LESSON
	2	FINAL EXAMINATION
	<u>13</u>	

RESERVE RETIREMENT CREDITS:

4

EXAMINATION:

Supervised final examination without text or notes; time limit, 2 hours.

MATERIALS:

MCI 11.19c, Installation, Operation, and Operator's Maintenance of Diesel-Engine-Driven Generator Sets.

Review lesson and answer sheet.

RETURN OF MATERIALS:

Students who successfully complete this course are permitted to keep the course materials.

Students disenrolled for inactivity or at the request of their commanding officers will return all course materials.

HOW TO TAKE THIS COURSE

This course contains 3 study units. Each study unit begins with a general objective which is a statement of what you should learn from that study unit. The study units are divided into numbered work units, each presenting one or more specific objectives. Read the objective(s) and then the work unit text. At the end of the work unit text are study questions which you should be able to answer without referring to the text of the work unit. After answering the questions, check your answers against the correct ones listed at the end of the study unit. If you miss any of the questions, you should restudy the text of the work unit until you understand the correct response. When you have mastered one study unit, move on to the next. After you have completed all study units, complete the review lesson and take it to your training officer or NCO for mailing to MCI. MCI will mail the final examination to your training officer or NCO when you pass the review lesson.

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MARINE CORPS INSTITUTE

Welcome to the Marine Corps Institute correspondence training program. By enrolling in this course, you have shown a desire to improve the skills you need for effective job performance, and MCI has provided materials to help you achieve your goal. Now all you need is to develop your own method for using these materials to best advantage.

The following guidelines present a four-part approach to completing your MCI course successfully:

1. Make a "reconnaissance" of your materials;
2. Plan your study time and choose a good study environment;
3. Study thoroughly and systematically;
4. Prepare for the final exam.

L. MAKE A "RECONNAISSANCE" OF YOUR MATERIALS

Begin with a look at the course introduction page. Read the **COURSE INTRODUCTION** to get the "big picture" of the course. Then read the **MATERIALS** section near the bottom of the page to find out which text(s) and study aids you should have received with the course. If any of the listed materials are missing, see Information for MCI Students to find out how to get them. If you have everything that is listed, you are ready to "reconnoiter" your MCI course.



Read through the table(s) of contents of your text(s). Note the various subjects covered in the course and the order in which they are taught. Leaf through the text(s) and look at the illus-

trations. Read a few work unit questions to get an idea of the types that are asked. If MCI provides other study aids, such as a slide rule or a plotting board, familiarize yourself with them. Now, get down to specifics!

II. PLAN YOUR STUDY TIME AND CHOOSE A GOOD STUDY ENVIRONMENT

From looking over the course materials, you should have some idea of how much study you will need to complete this course. But "some idea" is not enough. You need to work up a personal study plan; the following steps should give you some help.

(A) Get a calendar and mark those days of the week when you have time free for study. Two study periods per week, each lasting 1 to 3 hours, are suggested for completing the minimum two study units required each month by MCI. Of course, work and other schedules are not the same for everyone. The important thing is that you schedule a regular time for study on the same days of each week.



(B) Read the course introduction page again. The section marked **ORDER OF STUDIES** tells you the number of study units in the course and the approximate number of study hours you will need to complete each study unit. Plug these study hours into your schedule. For example, if you set aside two 2-hour study periods each week and the **ORDER OF STUDIES** estimates 2 study hours for your first study unit, you could easily schedule and complete the first study unit in one study period. On your calendar you would mark "Study Unit 1" on the

STUDY GUIDE

appropriate day. Suppose that the second study unit of your course requires 3 study hours. In that case, you would divide the study unit in half and work on each half during a separate study period. You would mark your calendar accordingly. Indicate on your calendar exactly when you plan to work on each study unit for the entire course. Do not forget to schedule one or two study periods to prepare for the final exam.

© Stick to your schedule.

Besides planning your study time, you should also choose a study environment that is right for you. Most people need a quiet place for study, like a library or a reading lounge; other people study better where there is background music; still others prefer to study out-of-doors. You must choose your study environment carefully so that it fits your individual needs.

III. STUDY THOROUGHLY AND SYSTEMATICALLY

Armed with a workable schedule and situated in a good study environment you are now ready to attack your course study unit by study unit. To begin, turn to the first page of study unit 1. On this page you will find the study unit objective, a statement of what you should be able to do after completing the study unit.

DO NOT begin by reading the work unit questions and flipping through the text for answers. If you do so, you will prepare to fail, not pass, the final exam. Instead, proceed as follows:

Ⓐ Read the objective for the first work unit and then read the work unit text carefully. Make notes on the ideas you feel are important.

Ⓑ Without referring to the text, answer the questions at the end of the work unit.

Ⓒ Check your answers against the correct ones listed at the end of the study unit.

Ⓓ If you miss any of the questions, restudy the work unit until you understand the correct response.

Ⓔ Go on to the next work unit and repeat steps Ⓐ through Ⓓ until you have completed all the work units in the study unit.

Follow the same procedure for each study unit of the course. If you have problems with the text or work unit questions that you cannot solve on your own, ask your section OIC or NCOIC for help. If he cannot aid you, request assistance from MCI on the Student Course Content Assistance Request included with this course.

When you have finished all the study units, complete the course review lesson. Try to answer each question without the aid of reference materials. However, if you do not know an answer, look it up. When you have finished the lesson, take it to your training officer or NCO for mailing to MCI. MCI will grade it and send you a feedback sheet listing course references for any questions that you miss.

IV. PREPARE FOR THE FINAL EXAM



How do you prepare for the final exam? Follow these four steps:

Ⓐ Review each study unit objective as a summary of what was taught in the course.

Ⓑ Reread all portions of the text that you found particularly difficult.

Ⓒ Review all the work unit questions, paying special attention to those you missed the first time around.

Ⓓ Study the course review lesson, paying particular attention to the questions you missed.

If you follow these simple steps, you should do well on the final. GOOD LUCK!

STUDY UNIT 1

700 SERIES GENERATORS

STUDY UNIT OBJECTIVE: UPON SUCCESSFUL COMPLETION OF THIS STUDY UNIT, YOU WILL BE ABLE TO IDENTIFY THE VARIOUS TYPES AND THE CAPABILITIES OF THE 700 SERIES GENERATORS. YOU WILL ALSO BE ABLE TO IDENTIFY PROCEDURES FOR INSTALLATION, OPERATION, AND PERFORMANCE OF OPERATOR'S MAINTENANCE.

"MARINE, I have a special assignment for you. For the next few days you are going to operate a generator set."

You have been told this by your unit leader, and you are asking yourself, "What do I do now?" This study unit will answer that question by providing you with the ability to identify the five types of generators and their characteristics, as well as determine how to install, operate, and perform limited maintenance on them.

Work Unit 1-1. DESCRIPTION

LIST BY NAME THE FIVE GENERATOR SETS THAT MAKE UP THE 700 SERIES.

DESCRIBE THE CAPABILITIES OF EACH OF THE FIVE TYPES OF GENERATOR SETS IN THE 700 SERIES.

The PU-708, 709, 710, 711, and 712 are the five generators that make up the 700 series. While these generators differ from each other in some ways, which will be discussed in this work unit, they are all a compact, transportable source of a.c. power. These generators offer precise 120/208 or 240/416 volts a.c. and each is driven by a water-cooled diesel engine.

Note: There are two general classifications of generator sets, Utility and Precise. "Utility" generator sets do not have close frequency and voltage regulation, and are used on loads where close regulation is not required (i.e. Lights). "Precise" generator sets, on the other hand, do have close voltage and frequency regulation, and are used on loads requiring close regulation (i.e. Communication equipment).

The generators incorporate radio interference componentry to prevent interference with the load, as well as safety devices to protect the generator. However, they do differ in some ways, and by comparing the capabilities listed in table 1-1, you should be able to see these differences.

Note: Throughout the text, Hz will refer to hertz and KW will refer to kilowatts. Hertz (Hz) is a measure of the frequency output of the generator. Kilowatt (KW) is a unit of power.

Table 1-1. Capabilities of 700 Series Generator Sets

	PU-708	PU-709	PU-710	PU-711	PU-712
FUEL TANK CAPACITY	25 GAL	25 GAL	40 GAL	40 GAL	50 GAL
OIL CAPACITY	11 QTS	11 QTS	15 QTS	15 QTS	19 QTS
COOLANT SYSTEM CAPACITY	13 QTS	13QTS	28 QTS	28 QTS	32 QTS
VOLTAGE OUTPUT	120/208 240/416	120/208 240/416	120/208 240/416	120/208 240/416	120/208 240/416
FREQUENCY OUTPUT	60 Hz	400 Hz	60 Hz	400 Hz	60 Hz
KW RATING	30 KW	30 KW	45 KW	45 KW	60 KW

By using table 1-1, you should see that the PU-708 and PU-709 have basically the same capabilities. The PU-708 and PU-709 have the same fuel, oil, and water capacities, voltage output, and KW rating. However, the two generators do differ in frequency output. The PU-708 generator puts out 60 Hz, while the PU-709 generator supplies 400 Hz.

The PU-710 and PU-711 have basically the same capabilities (table 1-1), except for the frequency output. When comparing the 708 and 709 with the 710 and 711, you should find that the fuel, oil, and water capacities vary, as well as the KW ratings. By using this information, you should be able to determine that a greater amount of power can be provided with the 710 or 711 than with the 708 or 709; in fact, 15 KW more.

The PU-712 is the last member of this family. It differs from the others in every way except voltage output (table 1-1). The fuel, oil, and water capacities are larger, as is the amount of power output (60 KW's) the generator can supply. You should be able to see by looking at table 1-1 that there is one constant factor in dealing with any of the members of the 700 Series; they all are capable of supplying the same voltage outputs.

EXERCISE: Answer the following questions and check your responses against those listed at the end of this study unit.

1. List the five generators found in the 700 Series family.
 - a. _____
 - b. _____
 - c. _____
 - d. _____
 - e. _____
2. The capabilities of the PU-708 and PU-709 differ. What is this difference?
3. Do the PU-710 and PU-711 provide a greater or lesser amount of power (KW) than the PU-708 and PU-709?
4. The PU-712 is a _____ KW rated generator.
5. The voltage output of all 700 Series generators is 120/208 or _____/_____.

Work Unit 1-2. INSTALLATION - UNCRATING

LIST THE THREE STEPS FOR UNCRATING THE 700 SERIES GENERATOR SET.

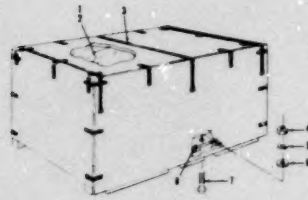
STATE WHAT SIZE FORKLIFT OR CRANE IS REQUIRED TO LIFT THE GENERATOR.

The first step for installing the generator for operation is uncrating. This is done in the following manner.

Unloading. This is the process of removing the generator from its carrier. This can be done by using a forklift or crane. The lifting capacity of the crane or forklift should be at least equal to the weight of the generator set. You should remove all tiedowns or blocking devices. Slowly lift the crate from the carrier and move it to the place where the generator set will be uncrated.

Removal of crate (numbers in parenthesis refer to figure 1-1). When uncrating the generator set, exercise great care with crowbars, pinch bars, and hammers to avoid damage to the generator set. Cut all reinforcing straps (3). Disconnect the crate top, ends, and sides by removing nails.

Removal of packing material. Remove the barrier bag (1), desiccant bag (2), carriage bolts (7), nuts (4), and washers (5 and 6). Remove any cushioning material from around the generator set. Remove all chocks and tiedowns which may be used to secure the set during shipment. Remove the bolts that mount the generator set to the wooden skid (8). If practical, store the wooden skid for use during reshipment. If desired, the generator set may be left attached to the wooden skid during operation.



1. Barrier bag
2. Desiccant bag
3. Reinforcing straps
4. Nut

5. Lockwasher
6. Flat washer
7. Carriage bolt
8. Generator set skid

Fig 1-1. Shipping crate.

EXERCISE: Answer the following questions and check your responses against those listed at the end of this study unit.

1. List the three steps for uncrating the 700 Series generator set.
 - a. _____
 - b. _____
 - c. _____
2. When unloading the generator from the carrier, the lifting capacity of the forklift should be at least _____ to the weight of the generator set.
3. During removal of crate from around generator set, you first remove straps and then remove the _____ out of the top, sides, and ends of crate.

Work Unit 1-3. INSTALLATION - MOVING

LIST THE PROPER EQUIPMENT FOR MOVING THE 700 SERIES GENERATOR A SHORT DISTANCE.

DESCRIBE THE PROCEDURE FOR MOVING A 700 SERIES GENERATOR WITH A FORK-LIFT.

DESCRIBE THE PROCEDURE FOR MOVING A 700 SERIES GENERATOR WITH A CRANE.

After the generator set has been uncrated, you may want to move it to an area where you can begin work on it. This can be accomplished by using the moving procedures listed below.

Equipment used to move the generator set. To move an unpacked generator set from one location to another, use a forklift truck with a minimum load rating no less than equal to the weight of the generator set or use an overhead crane with a minimum load rating no less than equal to the weight of the generator set.

Moving the generator set. When using the forklift, use the openings in the skid base assembly of the generator set as shown in figure 1-2. Guide the forks into the opening provided, and continue to move the forklift forward until the generator set comes in contact with the lift frame of the forklift. Lift the generator set and proceed to the point of servicing.

Note: Always have a man guide the forklift driver. Make sure the forklift forks come through openings in skid base on other side of unit before lifting so not to damage bottom of unit.

When using an overhead crane to move an uncrated generator set (fig 1-2) and engage the lifting hook of the crane in the lifting eye of the generator set (fig 1-2). Raise and lower the generator set slowly, stabilizing it manually to prevent it from rotating. Use this method of movement only for a very short distance or when removing the generator set from or placing it onto a transporter. The generator set may also be moved for short distances on its own skid using the towing ring and a suitable prime mover.

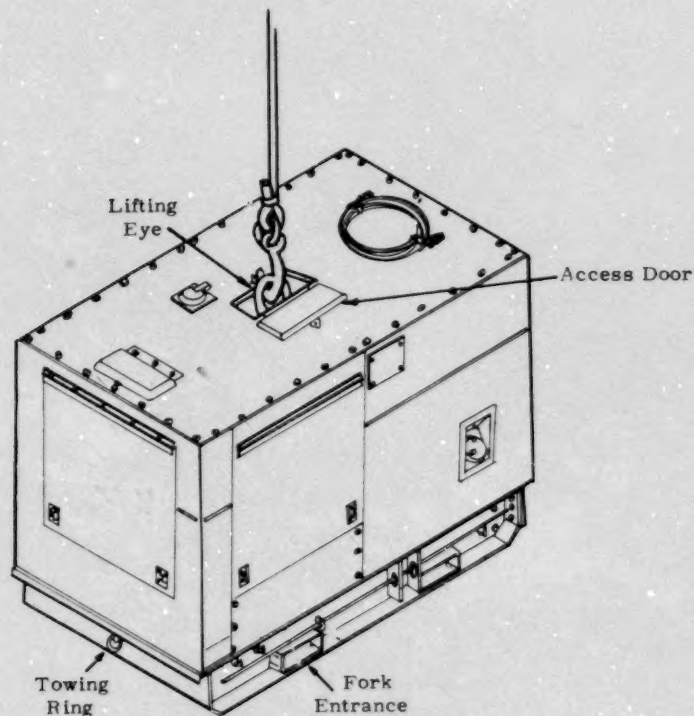


Fig 1-2. Generator set with lifting eye engaged.

EXERCISE: Answer the following questions and check your responses against those listed at the end of this study unit.

1. List the two types of equipment that should be used when moving a generator set from one point to another.

a. _____
b. _____

2. Describe the correct procedure for moving a 700 Series generator with a forklift.

3. Describe how to lift a 700 Series generator with a crane.

Work Unit 1-4. INSTALLATION - INITIAL SERVICING

LIST THE FIVE STEPS IN THE INITIAL SERVICING OF THE GENERATOR SET.

Prior to operating the generator set, you should perform the initial servicing of the set. This is when the consumable materials (fuel, coolant, and lubricating oil) should be added. The outside temperature (ambient temperature) at the installation site will determine the type of materials that are to be used. Table 1-2 shows typical quantities and materials.

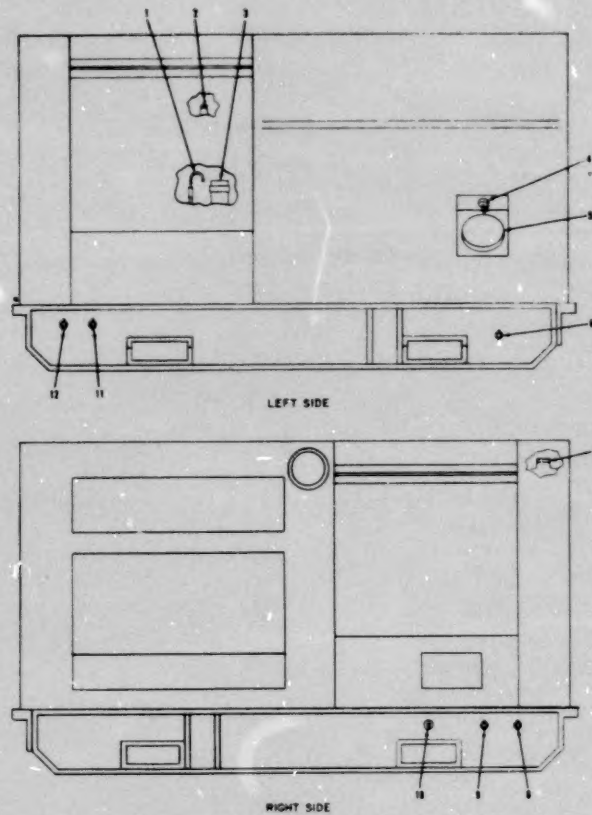
Table 1-2. Consumable Materials Required

COMPONENT OR SYSTEM	MATERIAL	TOTAL CAPACITY			TEMPERATURE RANGE	TYPE
		PU-708/G PU-709/G	PU-710/G PU-711/G	PU-712/G		
Fuel Tank	Fuel Oil	25 gal	40 gal	50 gal	+20° to +125° F. -25° to +20° F. -65° to -25° F.	Federal Specification VV-F-800A Grade DF-2 Federal Specification VV-F-800A Grade DF-1 Federal Specification VV-F-800A Grade DF-A
Engine Lubricating	Lubricating Oil	11 qt	15 qt	19 qt	+30° to +125° F. -20° to +30° F. -65° to -20° F.	Military Specification MIL-L2104C-OE-30 Military Specification MIL-L-2104-OE-10 Military Specification MIL-L-10295B-OE-5
Cooling System	Coolant	13 qt	28 qt	32 qt	+32° to +125° F. -25° to +32° F. -65° to -25° F.	Water 50 percent water and 50 percent Ethylene Glycol Full strength arctic anti-freeze compound per Military Specification MIL-A-11755C
Governor Actuator Linkage Lubrication Fitting	Grease	As required	As required	As req'd	+125° to -65° F.	Military Specification MIL-G-10924C

The first step in servicing the generator is to insure that all drain cocks (figs 1-3 and 1-4) are in their proper position, that is the radiator and fuel tank drain plugs should be fully closed, and the engine lubricating drain plug tight. The fording drain plugs should also be closed; however, the battery mount and air box drain cocks should be in the full open position.

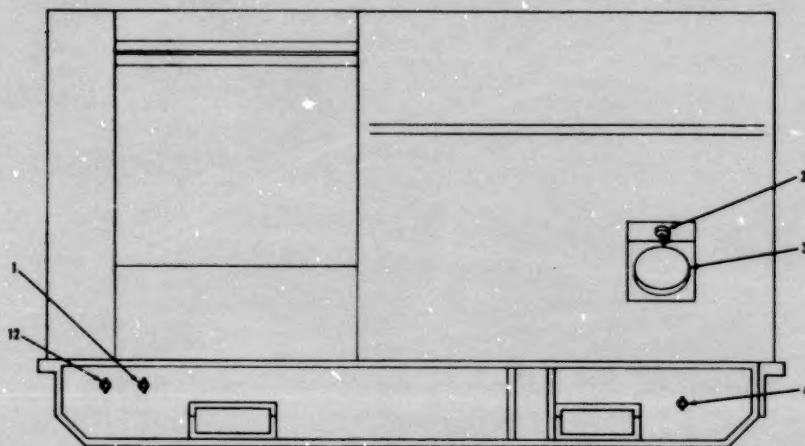
The second step would be to add engine coolant. It is recommended that you use an anti-freeze solution as a coolant even in warm weather or climate. This is due to the rust inhibitor contained in the antifreeze, and also because the antifreeze has a higher boiling point than water. After adding coolant to the radiator be sure and tighten the radiator cap securely to the right to prevent loss of coolant.

The third step is to activate the batteries. To activate new batteries, fill the cells with electrolyte to the slots in the filler well of each cell. Remember, electrolyte contains sulfuric acid which can cause severe burns. Therefore, HANDLE IT WITH CARE. Wear rubber gloves and a face shield. If you should spill some of the electrolyte on your skin or clothing, rinse the area immediately with clean water. Baking soda will help neutralize the effect of the acid. Avoid spilling electrolyte on painted surfaces. Once a battery has been activated, only water (distilled if available, clean if not) should be added when the fluid level is low. If you have to add water quite often, it is possible that there is a defect in the system such as a faulty battery charger which is causing the battery to overheat. You should report such a condition to the maintenance personnel. DO NOT add more electrolyte to a battery that already has electrolyte in it. Electrolyte gives off fumes which can be explosive; therefore, DO NOT smoke when servicing batteries.

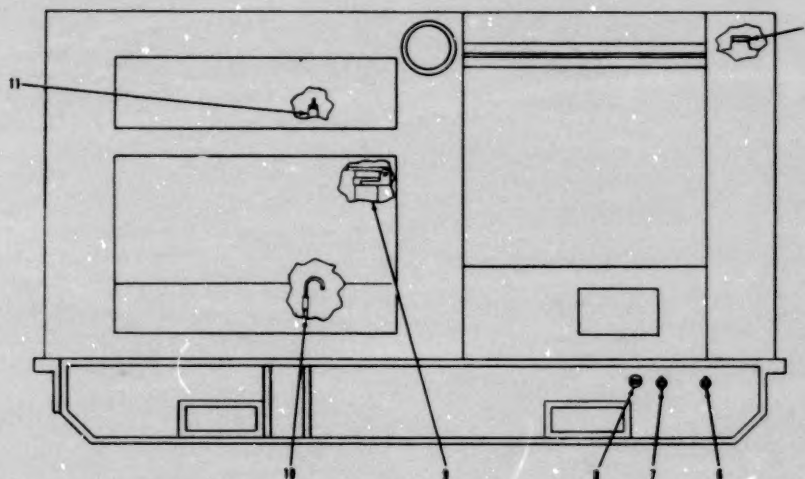


- | | |
|--|---------------------------------------|
| 1. Engine dip stick | 7. Radiator filler cap |
| 2. Governor actuator linkage lubrication fitting | 8. Radiator drain cock |
| 3. Engine oil filler cap | 9. Engine air box drain cock |
| 4. Auxiliary fuel supply fitting | 10. Engine lubricating oil drain plug |
| 5. Fuel tank filler cap | 11. Engine air box drain cock |
| 6. Fuel tank drain cock | 12. Battery mount drain cock |

Fig 1-3. Lubrication, filling, and drain points (PU-708/G and -709/G).



LEFT SIDE



RIGHT SIDE

1. Engine Air Box Drain Cock
2. Auxiliary Fuel Supply Fitting
3. Fuel Tank Filler Cap
4. Fuel Tank Drain Cock
5. Radiator Filler Cap
6. Radiator Drain Cock

7. Engine Air Box Drain Cock
8. Engine Lubricating Oil Drain Plug
9. Engine Oil Filler Cap
10. Engine Dip Stick
11. Governor Actuator Linkage Lubrication Fitting
12. Battery Mount Drain Cock

Fig 1-4. Lubrication, filling, and drain points (PU-710, -711, and -712).

The fourth step would be to fill the fuel tank. You can begin this by removing the fuel filler cap on the left side of the generator set. Remember to always maintain a constant metal to metal contact between the fuel tank filler neck and the spout or nozzle of the container. This should prevent sparking caused by static electricity. DO NOT forget to replace the cap.

The fuel tank may also be filled by connecting it to an auxiliary fuel supply. To fill the main fuel tank in this manner, the generator should be running, so that the batteries will not run down. To start filling, turn on the fuel transfer pump switch (fig-1-7, 53). The pump should then begin the transfer of fuel from the auxiliary supply to the main tank. After starting this process, you do not need to worry about the main fuel tank overflowing. The tank fuel level valve will prevent this by electrically turning off the fuel transfer pumps as the main tank reaches the full capacity.

After completing the initial servicing of the generator set it is a good practice to make a 360 degree check of it. Checking for loose wires, cables, nuts, broken parts or anything out of the ordinary and correct the discrepancy before starting the unit.

The fifth and final step is to insure that the generator set is lubricated. If not, you should lubricate the engine. The procedure for the initial lubrication of the engine is listed below. If the oil system has preservative in it, it must be flushed before the generator is operated. Open the generator set engine access door and remove the valve cover, being sure not to damage the cover gasket. Also remove the oil filler cap. Pour one to two quarts of oil over the rocker arms (this lubricates the push rods and cam rollers as well as the rocker arms) and add the rest to the engine crankcase. Replace the rocker arm cover, oil filler cap, and close the engine access door. The generator set has now been serviced and is prepared to be moved to a site for operation.

Note: If the valve cover is to be removed to lubricate rocker arms, the operator must have the assistance of a licensed mechanic.

EXERCISE: Answer the following questions and check your responses against those listed at the end of this study unit.

1. The list below contains the five steps in the initial servicing of the 700 Series generator set. Select the proper steps.
 - a. Fill fuel tank
 - b. Close/open drain cocks
 - c. Wash the generator
 - d. Activate the batteries
 - e. Add engine coolant
 - f. Paint on unit tactical marking
 - g. Lubricate engine
2. What at the installation site will determine the type of consumable material (fuel, coolant, lubricating oil) that will be added to the generator set during initial servicing? _____
3. During initial servicing of the generator, the radiator and fuel drain plugs should be fully _____.
4. During filling of the fuel tank, metal to metal contact should be maintained to prevent _____ from static electricity.
5. When filling the fuel tank from an auxiliary source, the engine should be running to prevent the _____ from going dead.
6. Before the addition of any consumable materials, the battery and air box drain valves should be fully _____.
7. After filling the fuel tank, you should insure that the engine is _____.

Work Unit 1-5. INSTALLATION - SITING

DESCRIBE THE BEST LOCATION FOR INSTALLING THE GENERATOR SET.

LIST THREE FACTORS TO CONSIDER WHEN POSITIONING THE GENERATOR.

STATE THE MAXIMUM DEGREE OF TILT AT WHICH THE GENERATOR CAN BE PLACED AND STILL FUNCTION PROPERLY.

LIST MAXIMUM DISTANCES THE 700 SERIES GENERATOR CAN BE PLACED FROM (1) A PARALLELED GENERATOR, (2) AUXILIARY FUEL SUPPLY, (3) REMOTE CONTROL AREA.

The generator set is now ready for operation. At this point you as the operator receive orders to take the generator to a specific area. First you arrange for transportation of the generator set, then you move out into the area to select a proper site for the generator set. When selecting a proper site, keep in mind the two following factors.

Location. Locate the generator set where there will be a minimum of moisture, dust, or corrosive fumes which may be drawn into it. Moisture condenses on generator parts and electrical controls causing corrosion which can seriously affect the operating efficiency of the generator. Dust and dirt cause needless extra wear on all moving parts. Be sure there is adequate ventilation for the engine, especially when sandbags are used for protection or sound-deadening purposes (six feet from radiator).

Positioning. There are several things you must take into consideration when positioning the generator set: (1) the needs of the user, (2) the tactical situation, (3) the terrain conditions, etc. The needs of the users may well be critical, depending on what type of equipment they are using, e.g., communications or hospital. This equipment may be very expensive, and it may also be sensitive, requiring precise hookup of the power cable for proper phasing. It is recommended that you check with the user before you connect the load (power) cable so that you can be sure the conductors of the cable are connected to the proper terminals avoiding possible damage to the equipment or injury to personnel. Ideally, the ground where you place the generator set should be dry, firm, and level, but this is not always possible. The generator set is designed to operate at 15° of tilt from level. If the angle of slope or tilt exceeds 15°, the fuel system will not operate properly. If it is not possible to level the ground with a shovel or some mechanical means (dozer, grader, etc.), it may become necessary to use boards or planks to make the generator set level. Each of the lines and cables issued with the generator set has a specific length, except the power cable; auxiliary fuel line -- 24 feet, paralleling cable -- 25 feet, and remote control cable -- 75 feet. Therefore, distances are restricted by the length of the cables and lines. It is recommended, as a safety precaution, that you use the full 24 feet of the auxiliary fuel line between the auxiliary fuel supply and the generator set. The tactical situation might require you to provide cover and concealment for the generator.

EXERCISE: Answer the following questions and check your responses against those listed at the end of this study unit.

1. Describe the best location for installing the generator set.

2. When using sandbags for protection or sound-deadening purposes, they should be at least _____ feet from the radiator.
3. List the three things that should be taken into consideration when positioning the generator set.
 - a. _____
 - b. _____
 - c. _____
4. The fuel system will not operate properly and the generator may not run if the angle of slope or tilt exceeds _____
5. List maximum distances (in feet) the 700 Series generator can be placed from the following.
 - a. Auxiliary fuel supply _____
 - b. Remote control area _____
 - c. Paralleled generator _____

Work Unit 1-6. INSTALLATION - GROUNDING

LIST THE TWO REASONS FOR GROUNDING A GENERATOR.

STATE HOW MANY INCHES THE GROUND ROD IS LEFT EXPOSED ABOVE THE GROUND TO OBTAIN THE BEST GROUND.

After the generator set has been properly sited, you should ground the set. Do not operate the generator set without a proper ground connection. The two main reasons for grounding the generator set is that electrical defects in the unit load lines or load equipment can cause severe electrical shock or electrocution when contact is made with an ungrounded system. These defects could cause the equipment to be damaged if the unit is left ungrounded. Avoid damage if at all possible because of the cost and importance of the equipment. It is recommended that you put a wooden pallet or other nonconductive material on the ground in front of the generator set, especially if the ground is wet. This will protect you from electrical shock.

To ground the generator set you must first remove the ground cable and clamp from the storage compartment on the right side of the generator set. The ground rod should be removed by loosening the bracket in the base on the left side of the generator set. Insert one end of the ground cable (1, fig 1-5) into the slot in the ground stud (4, fig 1-5) and tighten the nut (5, fig 1-5). Then drive the ground rod into the ground until the top of it is approximately three inches above the ground. This procedure will result in the best ground possible. Connect the ground cable and clamp to the ground rod as shown in figure 1-6 and tighten the setscrew (4, fig 1-6).

NOTE: Insure ground stud is free of paint before connecting ground wire to insure a sound electrical connection.

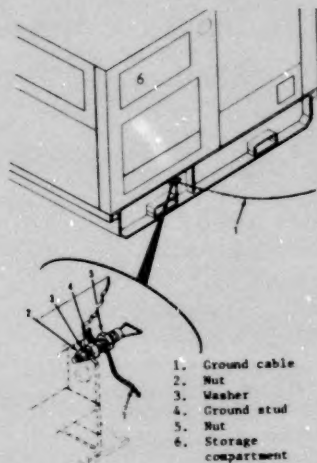


Fig 1-5. Generator cable connection at generator set.

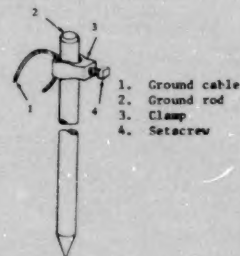


Fig 1-6. Ground cable connection at ground rod.

EXERCISE: Answer the following questions and check your responses against those listed at the end of this study unit.

1. List two reasons why it is important for you to ground the generator set.
 - a. _____
 - b. _____
2. List the two things that should be removed from the generator storage compartment when first grounding the set.
 - a. _____
 - b. _____
3. To obtain the best possible ground, the grounding rod should be left approximately _____ inches above the ground.
4. The equipment should not be operated without a proper _____

Work Unit 1-7. OPERATION - CONTROLS AND INDICATORS

MATCH FIVE OF THE VARIOUS CONTROLS AND INDICATORS FOUND ON THE CONTROL PANELS OF THE 700 SERIES GENERATOR SETS WITH THEIR FUNCTIONS.

Prior to beginning operation of the unit, you should become familiar with the functions and locations of the controls of the generator set. By using Table 1-3 and foldout figure 1-7, you should have no problem identifying the functions of the controls or indicators, and associating where the controls are located on the generator.

Table 1-3. Functions of Operating Controls and Indicators

Foldout Index	Control or Indicator	Function
2, 13, 21, 42	Panel light	Illuminates panels.
3, 38	Voltmeter	Indicates line-to-line and line-to-neutral a. c. RMS voltages as selected by the voltmeter selector switch. It is calibrated from 100 to 500 in increments of 5 volts. It is red lined at 120, 208, 240, and 416 volts. <u>Note:</u> If the voltmeter selector switch is in a line-to-neutral setting, you will NOT be able to red line the indicator needle on the voltmeter; therefore, the selector switch must be set in the desired position prior to operation.
4	Load contactor closed indicator light	Indicates closure of the load contactor.
5	Audio alarm shutoff switch	Permits silencing of audio alarm during fault indication.
6	Panel light switch	Energizes panel light on local panel assembly.
7	Load contactor switch	Activates load contactor.
8	Stop/start switch	Initiates starting sequence and controls generator set operation.
9	Remote/local start switch	Selects remote or local control panel for starting of generator set.
10	Ammeter selector switch	Selects the phase currents for measurement by the ammeter.
11	Ammeter	Indicates a. c. current of generator set in percent of full load rating. It is calibrated from 0 to 133 percent. It is red lined at 100 percent.
14	High coolant temperature indicator light	Illuminates when coolant temperature reaches $190^{\circ} \text{ F} \pm 5^{\circ}$.
15	Panel light switch	Energizes panel lights on remote panel assembly.
16	Low fuel pressure indicator light	Illuminates when fuel pressure drops to 30 ± 2 psi.
17	Low fuel level indicator light	Illuminates when level of fuel in the tank falls to a point which will operate the set at a rated load for only 50 ± 15 minutes.
18	Local start/stop control indicator light	Illuminates when local panel is selected for starting the generator set. <u>Note:</u> The lamp test switch will not cause the illumination of the local start/stop control indicator light unless the remote/local start switch is in the LOCAL START position.
19	Lamp test switch	Permits testing of fault indicator lights. It is a momentary contact, conventional toggle switch, springloaded to the OFF position.
20	Overload short circuit indicator light	Illuminates to indicate an overload or short circuit fault condition.

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Table 1-3. Functions of Operating Controls and Indicators -- continued

Foldout index	Control or indicator	Function
22	Reverse power indicator light	Illuminates when power flow into the set exceeds 10 percent of full load power during parallel operation.
23	Frequency high/low indicator light	Illuminates to indicate a high or low frequency condition as follows: 60 hertz sets - high 61 ± 0.5 hertz, low 59 ± 0.5 hertz; 400 hertz sets - high 410 ± 5 hertz, low 390 ± 5 hertz.
24	Frequency meter	Indicates the frequency of the a.c. voltage in hertz. The instrument is calibrated as follows: 60 hertz sets - 58 to 62 hertz with scale divisions of 0.1 hertz; 400 hertz sets - 388 to 412 hertz with scale divisions of 4 hertz.
25	Protection bypassed indicator light	Flashes to indicate that the generator set is being operated under emergency conditions without the benefit of any safety or protective device (except overspeed and short circuit).
26	Protection bypassed switch	Permits operation of the generator set under emergency conditions, bypassing all fault detection functions with the exception of engine overspeed and short circuit.
27	Fault reset switch	Permits resetting of the fault indicator lights and engine shutdown relay.
28	Frequency adjustment rheostat	Permits adjustment of the governed frequency of the generator set.
29, 31	Synchronizing lights	Indicate synchronization of frequency for paralleling of generator sets.
30	Synchronizing light switch	Energizes the synchronizing light circuitry during parallel operation.
32	Load contactor switch	Activates load contactor.
33	Voltage adjustment rheostat	Permits adjustment of the regulated terminal a.c. voltage of the generator.
34	Stop/start switch	Initiates starting sequence and controls generator set operation.
35	Emergency shutdown switch	Initiates an emergency shutdown sequence by energizing the engine shutdown relay and engine air shutoff valve solenoid.
36	Load contactor closed indicator light	Indicates closure of the load contactor.
37	Voltmeter selector switch	Selects line-to-line and line-to-neutral a.c. RMS voltages for measurement by the voltmeter.

Table 1-3. Functions of Operating Controls and Indicators -- Continued

Poldout index	Control or indicator	Function
39	Voltage high/low indicator light	Indicates a high or low generator set output voltage.
40	Low oil pressure indicator light	Illuminates when oil pressure falls to 30 ± 2 psi.
43	Coolant temperature gage	Indicates engine coolant temperature.
44	Oil pressure gage	Indicates engine oil pressure.
45	Operating time meter	Totalizes the operating time of the generator set in hours and tenths.
46	Battery charger ammeter	Indicates battery charging current.
47	Fuel level gage	Indicates the quantity of fuel in the fuel tank.
48	D.c. power circuit breaker	Protects and controls d.c. power to control circuits of the generator set.
49	Convenience receptacle	Provides 125 volts a.c. power for operation of small devices, trouble lamp, test equipment, etc.
50, 51	Parallel receptacles	Provide electrical connections for operation of generator sets in parallel configuration.
52	A.c. circuit breaker	Protects convenience receptacle circuit.
53	Fuel transfer pump switch	Activates fuel transfer pump for operation.
54	Emergency shutdown switch	Initiates an emergency shutdown sequence by energizing the engine shutdown relay and engine air shutoff valve solenoid.

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- | | |
|--|---|
| 1. Local panel assembly | 28. Frequency adjustment rheostat |
| 2. Panel light | 29. Synchronizing light |
| 3. Voltmeter | 30. Synchronizing light switch |
| 4. Load contactor closed indicator light | 31. Synchronizing light |
| 5. Audio alarm shutoff switch | 32. Load contactor switch |
| 6. Panel light switch | 33. Voltage adjustment rheostat |
| 7. Load contactor switch | 34. Start/stop switch |
| 8. Stop/start switch | 35. Emergency shutdown switch |
| 9. Remote/local start switch | 36. Load contactor closed indicator light |
| 10. Ammeter selector switch | 37. Voltmeter selector switch |
| 11. Ammeter | 38. Voltmeter |
| 12. Remote panel assembly | 39. Voltage high/low indicator light |
| 13. Panel light | 40. Low oil pressure indicator light |
| 14. High coolant temperature indicator light | 41. Auxiliary panel assembly |
| 15. Panel light switch | 42. Panel light |
| 16. Low fuel pressure indicator light | 43. Coolant temperature gage |
| 17. Low fuel level indicator light | 44. Oil pressure gage |
| 18. Local start/stop control indicator light | 45. Operating time meter |
| 19. Lamp test switch | 46. Battery charger ammeter |
| 20. Overload short circuit indicator light | 47. Fuel level gage |
| 21. Panel light | 48. D. c. power circuit breaker |
| 22. Reverse power indicator light | 49. Convenience receptacle |
| 23. Frequency high/low indicator light | 50. Parallel receptacle |
| 24. Frequency meter | 51. Parallel receptacle |
| 25. Protection bypassed indicator light | 52. A. c. circuit breaker |
| 26. Protection bypassed switch | 53. Fuel transfer pump switch |
| 27. Fault reset switch | 54. Emergency shutdown switch |

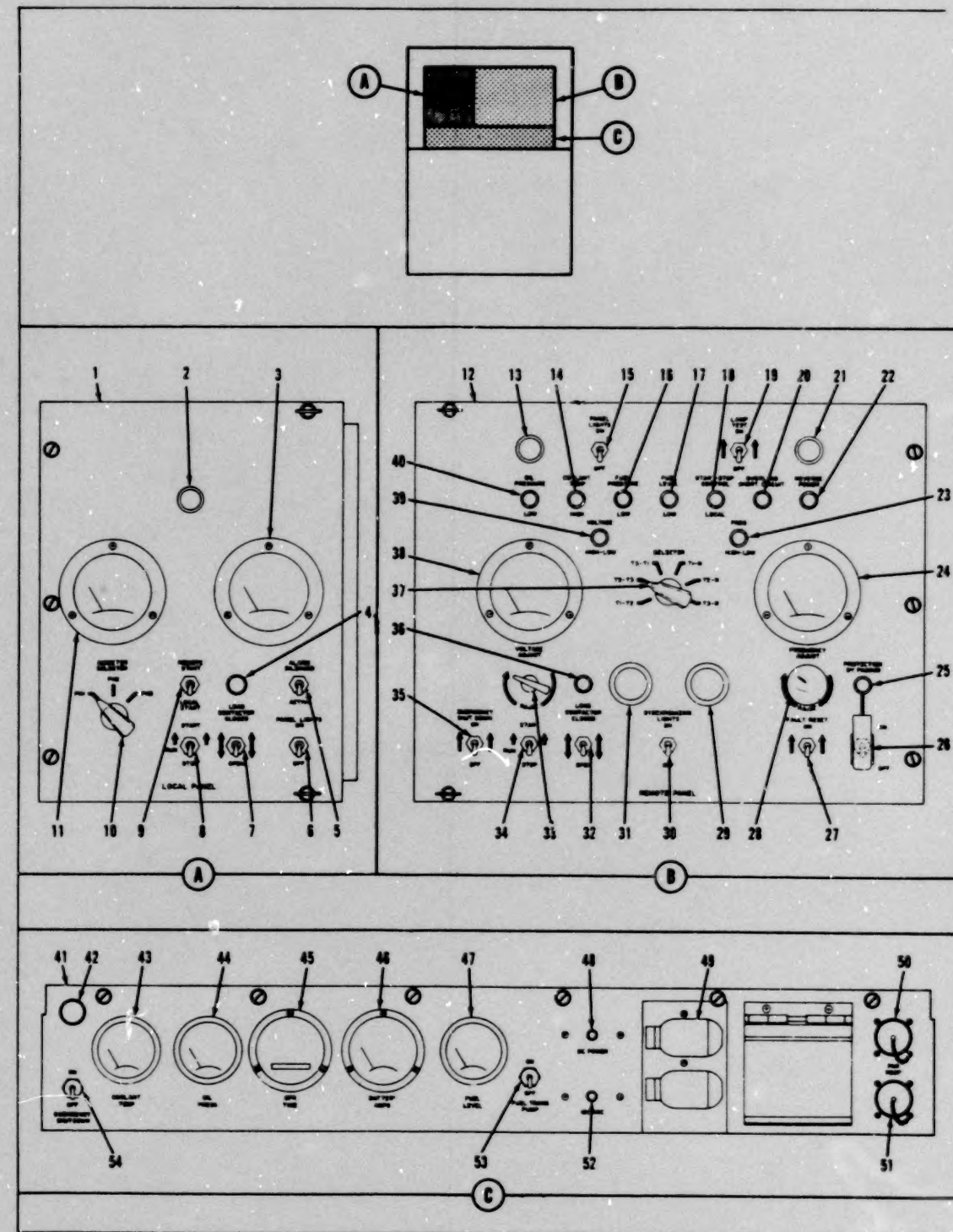


Fig 1-7. Location of controls and indicators.

EXERCISE: Match the functions listed in column 1 (Items 1-5) with the proper indicator listed in column 2 (a, b, c, d, e, or f). Check your answers with those listed at the end of this study unit.

Column 1	Column 2
<u>Functions</u>	<u>Indicators</u>
1. _____ Indicates line-to-line and line-to-neutral voltages.	a. Frequency meter
2. _____ Activates load contactor.	b. Emergency shutdown switch
3. _____ Indicates the frequency of the voltage in hertz (Hz).	c. Voltmeter
4. _____ Permits resetting of any faults.	d. Fault reset switch
5. _____ Initiates shutdown in case of emergency.	e. Load contactor switch
	f. Lamp test switch

Work Unit 1-8. OPERATION - SAFETY PRECAUTIONS

DESCRIBE THE CONDITION THE OPERATING AREA SHOULD BE IN TO AVOID ELECTRICAL SHOCK.

DESCRIBE HOW STATIC SPARKING CAN BE AVOIDED WHEN FUELING THE GENERATOR.

DESCRIBE THE TWO CONDITIONS THAT SHOULD EXIST BEFORE CONNECTING THE LOAD CABLES.

STATE THE PURPOSE OF INSPECTING THE GROUND CONNECTION BEFORE OPERATING THE GENERATOR.

DESCRIBE WHAT MUST BE DONE WITH EXHAUST FUMES IF THE GENERATOR IS OPERATED IN AN ENCLOSED AREA.

Now that you have familiarized yourself with the controls and indicators, you are just about prepared to start the generator set. Before you do, you should first insure that all safety precautions have been followed to protect the safety of personnel and equipment. Listed below are the safety precautions that should always be followed when working with diesel engine driven generator sets.

Condition of operating area. All personnel involved in the operation of the generator set should become familiar with the operating area and keep it dry or use insulating materials around the generator set to avoid the hazard of an electrical shock.

Filling fuel tank directly. When filling the fuel tank directly, always maintain a constant metal-to-metal contact between the fuel tank filler neck and the spout or nozzle to prevent sparking caused by static electricity.

Connecting load (power) cables. Before connecting the load cable to the generator set, make sure that the generator set is NOT connected in parallel to another generator set that is running, that it is NOT running, and that all switches are in the OFF or OPEN (deenergized) position.

Inspecting ground connection. Prior to starting the generator set, inspect the ground connection. Electrical defects in loadlines or load equipment can cause electrocution or severe burns when contact is made with an ungrounded system. Not grounding the set could cause malfunctions in the equipment.

Operation. Do not operate the generator set in an enclosed area unless the exhaust gases are piped to the outside. Continued breathing of exhaust fumes is dangerous. Do not inject ether into the engine manifold unless the engine is being cranked. Stay clear of all exposed electrical terminals when the generator set is operating.

Note: Remember the use of safety precautions will protect your life as well as the lives of others.

EXERCISE: Answer the following questions and check your responses against those listed at the end of this study unit.

1. Describe the condition the operating area should be in when operating the generator set.

2. Describe how static sparking can be avoided when fueling the generator.

3. Describe the two conditions that should exist before connecting the load cables.

4. State the purpose of inspecting the ground connection before operating the generator.

5. Describe what must be done with exhaust fumes if the generator is operated in an enclosed area.

Work Unit 1-9. OPERATION - POWER CONNECTION

MATCH THE PROPER TERMINAL NUMBER WITH THE PROPER PHASE WHEN CONNECTING THE LOAD CABLES.

Now that the area is safe, you are ready to proceed to the connecting of the load cables. The cables should always be connected before starting the generator. The proper methods of connection are discussed below.

There are several things you should check before you hook up the load cable to the generator set. First, make sure the load cable is NOT connected at the using equipment (the generator set end should be connected first). Second, make sure that the generator set is NOT operating, that it is NOT connected in parallel to another set that is operating, and that all switches are in the OFF or OPEN (deenergized) position. Now you can start connecting the load cable. Open the load board access door (fig 1-8). Insert the end of the load cable through the protective sleeve, allowing enough slack to reach the load board. Each conductor of the load cable is color-coded for identification purposes. However, because colors differ according to manufacturer, you should check with the user as to which conductor goes on a given terminal post. You should remember that terminal L1 = Phase A, L2 = Phase B, L3 = Phase C, and L0 = Neutral. Insert each conductor into the proper terminal post slot from the bottom and tighten each terminal nut. It is important that the proper phase relationship be maintained. In other words, the proper connections at both the generator set load board and at the other end of the power cable where the user is tied-in must be made or the protective system of the generator set will cause the engine to shut down (the overload short circuit indicator light will come on, indicating the malfunction). After the connections have been made, tighten the drawstring of the protective sleeve to prevent the entry of foreign matter. At the user end, the load cable should be secured by a clamp or some other means so that the cable will not be accidentally ripped from the terminals.

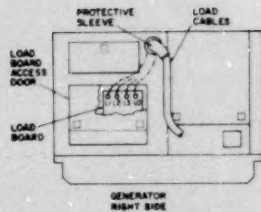


Fig 1-8. Power connection.

EXERCISE: Match the terminals listed in column 1 (items 1-4) to the proper phase listed in column 2 (a, b, c, d, or e). Check your answers with those listed at the end of this study unit.

Column 1 Terminal	Column 2 Phase
1. L1 _____	a. Neutral
2. L2 _____	b. Phase A
3. L3 _____	c. Phase B
4. L0 _____	d. Phase C
	e. Phase D

Work Unit 1-10. OPERATION - PRESTART INSPECTION

NAME THE TWO NAVMC FORMS YOU CAN USE AS CHECKLISTS WHEN CONDUCTING A PRESTART INSPECTION.

You are now ready to begin the first step in starting the generator. This step is the prestart (before operations) inspection. The prestart inspection should be performed by the operator before he starts the generator. It consists of performing a series of checks, as provided by the NAVMC form 10523 or 10524, which is shown in Table 1-4. Follow the column marked "before operation" and inspect everything required to be checked. The generator should now be ready to start.

Table 1-4. Prestart Inspection

INTERVALS				INSPECTION
BEFORE OPERATION	DURING OPERATION	AFTER OPERATION		
X			General	Make a visual inspection of the entire generator set for any obvious deficiencies, such as loose or missing bolts, nuts, and pins, and for bent, cracked, or broken parts. Inspect all wires and terminals for damage and loose connections.
X				Wipe up any spilled lubricating or fuel oil.
X	X		Fuel System	Inspect fuel system for leakage, condition of fuel lines, and integrity of fuel tank cap. See that tanks are full.
X				Inspect for proper connection of auxiliary fuel supply and that screen on bottom of fuel drum adapter assembly is free of obstructions.
		X		Inspect fuel pumps and system for leakage.
X		X		Open drain valves on fuel tank, filters, and strainers and remove any water or sediment.
X			Engine	Inspect engine mounts for security.
X				Inspect engine air box drain cocks to make sure they are in the full open position and free of obstructions.
X		X		Inspect oil in crankcase for proper level. If below proper level add oil as necessary.
	X			Inspect for unusual noises or operation such as too much vibration, overheating, lack of power, oil leakage, excessive smoking, and engine failing to respond to the controls. Shut down the generator set under such conditions. Report deficiencies noted to proper maintenance personnel.
X			Exhaust System	Inspect muffler for condition and security.
X	X			For generator sets that are operating indoors, inspect exhaust extensions for condition, security, and leakage.
X			Generator	Inspect generator screens for cleanliness.
		X		Inspect generator attaching hardware for security.
X			Control Panels	Inspect meter and gage faces for cleanliness.
X				Inspect panel illumination lights for proper operation.
	X			Inspect controls and indicators for proper operation.
X			Cooling System	Inspect radiator for proper coolant level. Add water or antifreeze as necessary.
X				Inspect radiator cooling fins for obstructions.
X	X			Inspect cooling system for leakage.
	X			Inspect radiator louver control valve for proper operation.
X				Check fan belt for proper tension.
X			Batteries	Inspect battery electrolyte for proper level. Add distilled water as required.
X				Inspect battery cables and terminals for corrosion and security.
X				Inspect battery mount drain cock to make sure it is in the full open position and free of obstructions.
X			Before Starting	Inspect generator set ground to make sure all connections are clean and tight.
X				Inspect generator set to make sure it is free of tools, equipment, and personnel.
X				Inspect load cables for security and proper connection.
X				Make sure load contactor is in the open position.
		X	Protection	Make sure all doors and panels are closed.

EXERCISE: Answer the following questions and check your responses against those listed at the end of this study unit.

1. Which NAVMC form(s) provides a series of checks to follow when performing a prestart inspection?

2. When should a prestart inspection be made?

Note: Use Table 1-4 in answering the following questions (3-5) true or false.

3. When making a prestart inspection, the load contactor is in the open position.

True _____

False _____

4. Prior to starting, you should inspect fuel pumps and systems for leakage.

True _____

False _____

5. The last thing you should do before starting is to insure that all panels and doors are secured.

True _____

False _____

Work Unit 1-11. OPERATION - OPERATING THE GENERATOR

LIST THE THREE PROCEDURES FOR OPERATING THE GENERATOR SET.

MATCH SPECIFIC OPERATING STEPS FROM EACH PROCEDURE WITH THE CORRECT PROCEDURE.

Now that the generator is prepared to start, your next step is to learn how to start the generator, monitor it, and shut it down after operation is finished.

Starting procedures. The generator set may be operated at ambient (outside) temperatures of + 125° to - 65° F. It may be started using the controls on either the local or remote panel following the procedures described below. If the generator set has not been run for a couple of weeks, it should be run for about 15 minutes to dry any condensation before putting a load on it.

Local panel starting (numbers in parenthesis refer to figure 1-7). Just a word of caution before the starting procedure is described. Make sure that the frequency and voltage rheostats are turned counterclockwise before starting the generator set, because the engine governor is connected to the circuit and will cause the set to run fast to try and satisfy the demand placed on it by the rheostat. If the rheostat is set too high, the overspeed device will shut the engine down. Now, with this thought in mind, go through the starting procedure. Press in the d.c. circuit breaker button (48). Turn the remote/local start switch to LOCAL START. The local start/stop control indicator light (18) should light up. Turn the start/stop switches (8 and 34) to STOP and make sure all other switches are in the OFF or OPEN position. The fuel transfer pump switch (53) should be in the ON position if an auxiliary fuel supply is being utilized. Turn the frequency and voltage adjustment rheostats (28 and 33) counterclockwise. Turn the lamp test switch (19) to ON and check for illumination or indicator lights. If any fault indicator lights light up, turn the fault reset switch (27) to ON and then return it to the NORMAL position. All fault indicator lights should go out except the local start/stop control indicator light; if not, do not start the generator set.

Caution: Do not crank the engine more than 30 seconds at a time. Allow the starter to cool for a minimum of three minutes between cranking.

Turn and hold start/stop switch (8) to START until the engine starts to accelerate under governor control, then release the switch to RUN position. Permit the engine to warm up to operating temperature (160° - 185° F) and make sure that the oil pressure is at the proper operating range (45 to 60 psi). Adjust the voltage and frequency to the desired values by turning the rheostats (28 and 33) clockwise to increase the rating and counterclockwise to decrease the rating. The rated values are found in the quick reference data table in the TM for the particular generator set being operated. (Example: PU-708, 60 Hertz-120 or 208 volts.) If adjusting the rheostats does not bring the outputs to the proper rated values, shut down the generator set and report it to the proper maintenance personnel. If the readings are correct, turn and hold the load contactor switch (7) to CLOSED until the load contactor closed indicator light (4) lights up, indicating that the load contactor is closed and the generator set has begun supplying power to the load.

Remote panel starting (numbers in parenthesis refer to figure 1-7). The same precautions apply to starting the generator set from the remote panel as those applied to starting the generator set from the local panel. In this case however, turn the remote/local start switch (9) to REMOTE START.

Note: The local start/stop control indicator light (18) will not light when the lamp test switch (19) is turned to ON unless the remote/local start switch (9) is in the LOCAL START position.

Turn the start/stop switches (8 and 34) to STOP and make sure that all other switches are in the OFF or OPEN position. The fuel transfer pump switch (53) should be in the ON position if an auxiliary fuel supply is being used. Turn the frequency and voltage adjustment rheostats (28 and 33) counterclockwise. Press the d. c. circuit breaker button (48) IN. If any fault indicator lights light up, turn the fault reset switch (27) to ON and then return it to the NORMAL position. All fault indicator lights should go out; if not, do not start the generator set. Turn the lamp test switch (19) to ON and check for illumination of indicator lights. Turn and hold the start/stop switch (34) to START until the engine starts to accelerate under governor control. Release the switch to the RUN position. Let the engine warm up to operating temperature and make sure that the oil pressure is within the proper range. Adjust the voltage and frequency to the desired level with the rheostats (28 and 33). If the frequency and the voltage are properly set, turn and hold the load contactor switch (32) to CLOSED until the load contactor closed light (36) lights up, indicating that the load contactor is closed and that the generator has begun supplying power to the load.

Note: An emergency shutdown of the generator set by one of the protective devices will cause the load contactor switch to kick out. It must be reset manually to restore power to the load. Sometimes the air box damper does not retract, making it necessary to reset it manually. This is done by pulling down on the control arm.

Monitoring procedure. After the generator set is running and the required power is being provided to the load, your job is still not over. You must insure that the generator continues to provide the required power to the load. By checking those items marked with an "X" in the during operations column (table 1-4), you can insure that the generator set will continue to perform efficiently.

Shutdown procedure. Now that you have accomplished your mission and provided power to the load successfully for a prolonged period of time, and there is no longer a need for the generator, you should begin shutdown procedures. The generator set may be shut down using the controls on the local panel or on the remote panel. Follow the procedure listed below when shutting down the generator set, whether you are using the local or the remote panel.

Note: In the event of an emergency, the generator set is shut down by turning either emergency shutdown switch (35 or 54, figure 1-7) to ON. If possible, notify the user before shutting down (the user equipment may be damaged in a sudden shutdown).

The normal sequence for shutting down the generator set is as follows: Turn the load contactor switch (7 or 32, foldout -- remember, the numbers in parenthesis refer to figure 1-7) to OPEN. The load contactor closed lights (4 or 36) should go out. Let the engine run without load for two or three minutes. Then turn the start/stop switch (8 or 34) to STOP. Open (deenergize) the d. c. power circuit breaker (48) and turn all other switches to OFF. Perform all inspection requirements in figure 1-10 that have X in the "after operation" column.

EXERCISE: Answer the following questions and check your responses against those listed at the end of this study unit.

1. List the three procedures for operating the generator set.
 - a. _____
 - b. _____
 - c. _____
2. The generator set may be started using either the local or _____ panel.
3. The generator should not be cranked for more than _____ seconds when starting generator.

Note: Match the operating steps in column 1 (items 4-7) with the correct procedure in column 2 (a, b, or c). Check your responses with those listed at the end of this study unit.

Column 1	Column 2
<u>Operating steps</u>	<u>Procedures</u>
4. _____ Operate generator 2-5 minutes before stopping generator.	a. Starting
5. _____ Turn frequency and voltage rheostats counterclockwise.	b. Monitoring
6. _____ Inspect for unusual noises, overheating oil leakage.	c. Shutting down
7. _____ Check for illumination of indicator lights.	

Work Unit 1-12. OPERATION - OPERATING UNDER UNUSUAL CONDITIONS

MATCH THE UNUSUAL OPERATING CONDITION WITH A SPECIFIC OPERATING PROCEDURE FOR THAT CONDITION.

You should be familiar now with starting and operating the generator set under normal conditions. The occasion may arise, however, when you will need to be familiar with operating the generator set under unusual conditions. Listed below are a few of the unusual conditions you may encounter and the measures you should take to insure the proper operation of the generator. The numbers in parenthesis refer to figure 1-7.

Emergency conditions. Sometimes it may become necessary to continue operating the generator set even though a condition arises that activates one or more of the generator's protective devices. To operate the generator set in such a situation, lift the red switch cover in the lower right corner of the remote panel and turn the protection bypassed switch (26) to ON. This will lock out all protective devices with the exception of overspeed and short circuit and cause the protection bypassed indicator light to blink on and off until the switch is turned to OFF. To start a generator set that has shut down due to overheating, low fuel level, etc., proceed as follows:

- Turn and hold the fault reset switch (27) to ON.
- Push the start/stop switch (8) up to start the generator set.
- Turn the protection bypassed switch (26) to ON.
- Turn the fault reset switch (27) to OFF.
- Reset the load contactor switch (7).
- Engage the fault reset switch (27) to see if the fault is still present.

Extreme heat. To insure that the generator set operates satisfactorily under conditions of extreme heat, check the coolant level in the radiator daily and add clean fresh water as necessary. Check the radiator to see that there are no obstructions in the cooling fins. Check the fan belts for proper adjustment. Check for leaks and, if necessary, use an approved rust inhibitor to prevent formation of rust and scale. Make sure that the radiator louver control valve is operating properly. If the louver control valve is not operating properly, open the louvers using the manual louver control handle. Keep the generator set free of dirt and grime. It is important that ventilating screens and louvers be free of obstructions which may restrict airflow.

Dusty or sandy areas. If the generator set is permanently installed, erect a protective shelter for it. In temporary installations, utilize natural barriers as much as possible. Keep all access doors and panels closed when the generator set is not in operation. Where water is available, wet down the surrounding terrain beyond the immediate operating area. In sandy or dusty areas, filters and strainers must be serviced more frequently than under normal conditions. In an extremely dusty or sandy environment, the air cleaner may require servicing after every four operating hours.

Salt water areas and humid conditions. Use only fresh water in the cooling system and flush the system frequently. Use an approved rust inhibitor to prevent the formation of rust and scale. Coat the exposed metal surfaces with rustproofing material. Remove rust immediately and apply paint or rustproofing material. KEEP THE GENERATOR SET WELL LUBRICATED. To insure that the generator set will operate satisfactorily under humid conditions, erect a portable shelter if possible, if not, keep the generator set covered, when not in use, with canvas or other waterproof material. Wet the generator set frequently with fresh water, being careful not to get the electrical equipment wet. Inspect all painted surfaces for cracks or peeled or blistered paint. Repair defects and repaint surfaces.

EXERCISE: Match the unusual operating condition listed in column 1 (Items 1-4) with a specific operating procedure for that condition listed in column 2 (a, b, c, d, or e). Check your responses against those listed at the end of this study unit.

Column 1	Column 2
<u>Unusual operating condition</u>	<u>Operating procedure</u>
1. <u>Emergency conditions</u>	a. Check coolant level daily and add clean fresh water as necessary.
2. <u>Extreme heat</u>	b. Turn the protection bypassed switch to ON.
3. <u>Dusty or sandy areas</u>	c. Keep the generator set well lubricated.
4. <u>Salt water areas and humid conditions</u>	d. Wet down surrounding terrain beyond immediate operating area.
	e. Add saltwater to cooling system.

Work Unit 1-13. OPERATOR'S MAINTENANCE

NAME THE ECHELON OF MAINTENANCE AUTHORIZED FOR THE OPERATOR TO PERFORM.

LIST THE FIVE ITEMS AUTHORIZED FOR OPERATOR'S MAINTENANCE.

Operator's maintenance. If you do not take proper care of your body, chances are that you will become sick. You might even have to go to a hospital. This will result in your being out of circulation for a while. The same will occur to the generator set for which you are responsible if you do not take proper care of it. In fact, a generator set can be permanently deadlined (not able to operate) as result of improper operator's maintenance. In the previous work units you have covered the generator set. After you read and study this work unit, you should be able to perform operator's maintenance and insure the proper operation of the generator. The operator is permitted to perform only 1st echelon maintenance, and this consists of the items discussed below.

Inspection. The generator set must be inspected systematically before, during, and after operation so that defects may be discovered and corrected before they result in serious damage or failure. The necessary preventive maintenance services should be performed before operation. Defects discovered during the operation of the generator set should be noted for correction as soon as operation ceases. Stop operation immediately if a deficiency is noted during operation which would damage the equipment if operation were to continue. After operation, services should be performed after the unit has stopped for the day. Defects or unsatisfactory operating characteristics beyond the scope of the operator must be reported to proper maintenance personnel. Figure 1-10 lists the operator's inspection requirements and the interval at which they should be performed.

Cleaning. To prevent the buildup of pollutants which may cause damage to operating components or systems of the generator set, the generator set should be cleaned periodically. This is a responsibility of the operator. Cleaning operations should be performed only on the generator sets that are not operating or not connected in parallel with another generator set. Painted metal surfaces should be washed with a mild soap-water solution, rinsed with clear water, and wiped with a clean, dry, lint-free cloth. Hard incrustations of dirt may be scrubbed off with a bristle brush that has been dipped in a drycleaning solvent such as Federal Specification P-S-661. The scrubbed area should then be rinsed with clear water. Linkages and control rods should also be cleaned with the same type drycleaning solvent as above and dried with a clean, lint-free cloth. Remove corrosion from the battery terminals, cables, and hold-down frames with a wire brush. Clean the control panel plexiglass window using a clean cloth moistened with a cleaning and polishing compound that is not an abrasive that would scratch the plexiglass (Military Specification MIL-C-18767 is recommended).

Servicing. To extend the operating life of the generator set, certain components have to be serviced on a regular basis. You, as the operator, will assist the maintenance mechanic in this servicing. The components are the engine ether starting aid, lubricating oil filter, air filter, fuel filter and strainer, and the electric fuel transfer pumps (these pumps should be serviced every 200 operating hours). These components are serviced during the quarterly PM of the generator set. Remember, servicing these components is not within the responsibility of the operator himself and must be done under the supervision of qualified maintenance personnel.

Note: Replenishing consumable (fuel and lubricants) materials is an important part of servicing equipment, and the operator's responsibility.

Lubricating. Another responsibility of the operator is to lubricate the generator set at proper intervals. This is essential to extend the operating life of the generator set's components. Under normal conditions, change the engine lubricating oil every 100 operating hours. The engine uses 1 1/2 to 2 quarts of oil every 16 operating hours. This is normal, but, if you have to add more oil when you check the crank-

case oil level, then you should inform the mechanic since a part could be defective or something else could be wrong. Lack of lubrication can cause serious damage to the engine. Refer to table 1-3 for type and quantity of lubricants and to figure 1-9 for filling and drain points. For lubrication requirements of the engine components, refer to the appropriate TM. Keep all lubricants, grease and oil, in closed containers and store them in a clean, dry place away from heat. Do not permit dirt, dust, water, or foreign matter to mix with the lubricant. Operate the engine immediately after lubricating it and check for leaks.

Adjustments. During generator set operation, if you find that the frequency or voltage outputs are over or under their rated values, you must adjust them. A clockwise adjustment of the rheostats (28 and 33, foldout) will increase the voltage or frequency. A counterclockwise adjustment will decrease the voltage or frequency. If the adjustments do not bring the outputs to the proper rated value, shut down the generator set and report the discrepancy to the proper maintenance personnel.

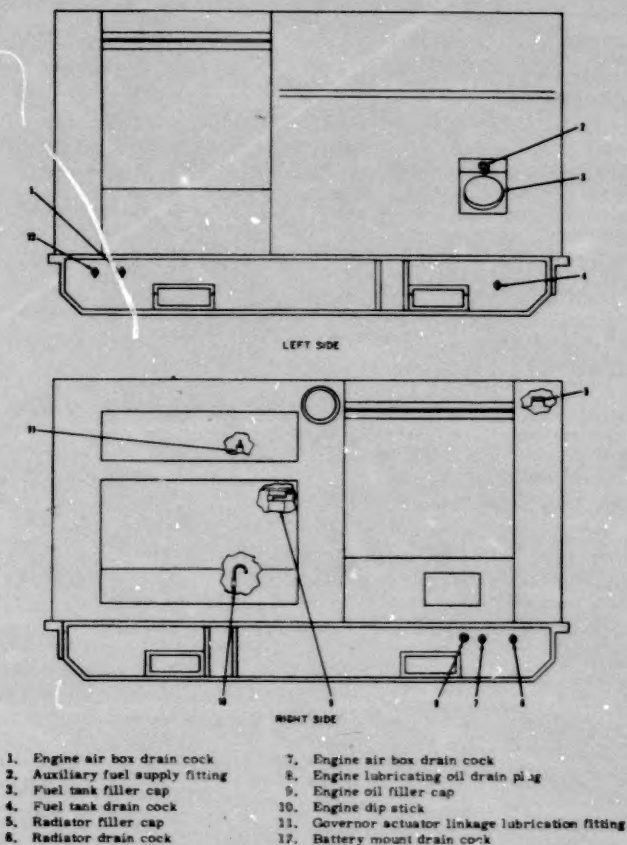


Fig 1-9. Lubrication, filling, and drain points.

Note: Above figure applies to the PU-710/G, PU-711/G, and PU-712; see figure 1-5 for a similar PU-709/G model.

EXERCISE: Answer the following questions and check your responses against those listed at the end of this study unit.

1. Name the echelon of maintenance authorized for the operator to perform.

2. List the five items authorized for operator's maintenance.

- a. _____
- b. _____
- c. _____
- d. _____
- e. _____

Work Unit 1-14. RECORDS AND FORMS

LIST THE TWO RECORDS THAT MAY BE USED BY THE OPERATOR WHILE OPERATING THE GENERATOR.

STATE THE PURPOSE OF THE NAVMC 10523 AND THE NAVMC 10524.

Forms and records. The operator is responsible for performing routine preventive maintenance on the generator set assigned to him. He is also responsible for entering the required data on the applicable forms. The forms which will be covered here are also a means for recording the hours that the generator set has been operated so that preventive maintenance may be scheduled and fuel consumption determined.

Engineer Equipment Operational Record, NAVMC 10523 (figs 1-10 and 1-11). The purpose of this form is to provide the operator with the authority to operate an item of equipment on an assigned mission. It also provides the operator with a list of the required scheduled maintenance services to be completed, as well as serving as a daily preventive maintenance checklist. Certain blocks on this form are filled out by the dispatcher before he gives it to the operator (these blocks are marked with asterisks "+" as in figure 1-10). The operator fills out the blocks pertaining to operation and maintenance of the generator set while it is under his control, these blocks are marked with "Y" as in figure 1-10. Before leaving the equipment pool, the operator performs his before-operation services as indicated on the operational record (fig 1-11) and in the appropriate TM. If the dispatcher has indicated that other services are due, such as oil change, lubrication service, or other scheduled preventive maintenance, the operator makes sure that these services are performed. He should then insert the appropriate entries on the NAVMC 10523 and initial each block containing a checkmark to indicate that these services have been performed. While operating the generator set, the operator checks his during-operation services as indicated on the form and in the appropriate TM. After the job has been completed, the operator obtains a signature of release, on the form, from the job supervisor. Upon returning to the equipment pool, the operator services the generator set and performs the after-operation PM services as indicated on the form and in the appropriate TM. After all the appropriate entries have been made and all required services performed, the operator returns the NAVMC 10523 to the dispatcher. If at any time while the generator set is under his control, the operator notices a discrepancy, he should make a note in the remarks column of the form.

DATE 3 Oct 8		EQUIPMENT Generator Set (GEO) PV-712/1r		USMC OR SERIAL NO 433712		ORGANIZATION Support Co	
		TIME		HOURS OR MILES		REPORT TO (Location)	
OPERATIONAL	1ST OPERATOR Cpl Thorne		IN	2400	STOP	303	MSGT McKinney Butler Blvd Construction site
	DISPATCHER'S SIGNATURE Sgt Montgomery		OUT	1800	START	298	
			TOTAL	6	TOTAL	5	
	2ND OPERATOR		IN		STOP		
	DISPATCHER'S SIGNATURE		OUT		START		
		TOTAL		TOTAL			
WORK PERFORMED		1ST OPERATOR Cpl Thorne		Y		Power for new building	
		2ND OPERATOR				Y	
SERVICE	FUELS Y		LUBES Y		OIL CHANGE		LUBRICATION
	DIESEL (GAL)	GAS (GAL)	OE (QTS)	GO (QTS)	GREASE (LBS)	HOUR/MILE DUE	HOUR/MILE COMPLETED
	30		2			400 *	Y
REMARKS							
						PM SERVICE	
						TYPE PM DUE	
						HOUR/MILE DUE	
						HOUR/MILE COMPLETED	
						8 * 306 *	
						1ST OPERATOR'S SIGNATURE Cpl Thorne	
						2ND OPERATOR'S SIGNATURE	
						EQUIPMENT FOREMAN'S SIGNATURE MSGT L. Schuckler	

ENGINEER EQUIPMENT OPERATIONAL RECORD

(11249) NAVMC 10523 (REV. 12-75) (PREVIOUS EDITIONS MAY BE USED.)
 SN 6000-00-005-4303 U/1EA

Fig 1-10. Engineer Equipment Operational Record (Front).

DAILY "A" PM SERVICE									
Legend for marking									
A - Adjust		S - Service		X - Adjustment/Repair Required					
C - Check		V - Verify		O - Detect Corrected					
L - Lubricate		/ - Not applicable							
ITEM	COVERAGE	OPERATION			8 HOUR	10 HOUR			
		BEFORE	DURING	AFTER			Y	N	
1	BATTERY, FUEL, LUBRICANTS	C		C	✓	✓			
2	LEAKS, GENERAL	C		C	✓	✓			
3	FUEL, OIL, WATER	V		V	✓	✓			
4	ENGINE SHUTDOWN	C		C	✓	✓			
5	INSTRUMENTS	C	C		✓	✓			
6	SAFETY DEVICES	C		C	✓	✓			
7	TOOLS AND EQUIPMENT	C		C	✓	✓			
8	PUBLICATIONS	V		V	✓	✓			
9	CLUTCH	V	C		✓	✓			
10	STEERING	C	C		✓	✓			
11	ENGINE OPERATION	C		C	✓	✓			
12	UNUSUAL NOISES	C	C		✓	✓			
13	LIGHTS AND REFLECTORS	C		C	✓	✓			
14	AIR TANKS	S		S	✓	✓			
15	DRIVE BELTS	C		C	✓	✓			
16	BATTERY ELEC. LEVEL	C		C	✓	✓			
17	ANTIFREEZE TEST TO	V		V	✓	✓			
18	SERVICE BRAKES	V	C		✓	✓			
19	TRANSMISSION	C	C		✓	✓			
20	AIR FILTER	V		V	✓	✓			
21	FUEL FILTERS	S		S	✓	✓			
22	TIRES/TRACK	C		C	✓	✓			
23	Ground connection	C		C	✓	✓			
24	Lead cables	C		C	✓	✓			
25	Lead contactor	C		C	✓	✓			
NOTES									
1. Add other coverages and procedures designated by the appropriate technical manual.									
2. 8 and 10 hour scheduled PM's are considered as daily PM services.									
3. If repairs are required, note the equipment status.									

REMARKS * Lead contactor should be in the open position.

Fig 1-11. Engineer Equipment Operational Record (Reverse).

For more detailed information on filling out the NAVMC 10523 and NAVMC 10524 you can refer to TM 4700-15/1D or MCI 1342.

NOTE: When this form is completed, transcribe all information from Section A and last entry from Section B to card NAVMC 1000.

1-27

Answers to Study Unit # 1 Exercises

Work Unit 1-1.

1. a. 708
b. 709
c. 710
d. 711
e. 712
2. frequency output
3. Greater
4. 60 KW
5. 240/416

Work Unit 1-2.

1. a. Unloading
b. Removal of crate
c. Removal of packing
2. equal
3. nails

Work Unit 1-3.

1. a. Forklift and
b. Overhead crane
2. Guide the forks into the openings provided in the skid base assembly. Continue to move the forklift forward until the generator comes in contact with the lift frame. Lift the forklift and proceed to the point of servicing.
3. Open the lifting eye access door on top of set and engage lifting hook of crane in the lifting eye of the generator. Raise and lower slowly, manually stabilizing to prevent rotation.

Work Unit 1-4.

1. a, b, d, e, g
2. The outside temperature (ambient temperature)
3. closed
4. sparking
5. batteries
6. open
7. lubricated

Work Unit 1-5.

1. Locate the generator set where there will be a minimum of moisture, dust, or corrosive fumes.
2. 6
3. a. Needs of user
b. The tactical situation
c. The terrain condition
4. 15°
5. a. 24 feet
b. 75 feet
c. 25 feet

Work Unit 1-6.

1. a. Avoid electrical shock
b. Avoid damage to equipment
2. a. Ground cable
b. Clamp
3. 3
4. ground.

Work Unit 1-7.

1. c.
2. e.
3. a.
4. d.
5. b.

Work Unit 1-8.

1. The area should be kept dry, or insulating materials should be used around the generator.
2. Maintain a constant metal-to-metal contact between the fuel tank filler neck and the spout or nozzle.
3. a. Make sure the generator is not connected in parallel to another generator set that is running.
b. Make sure that all switches are in the OFF or OPEN position.
4. To avoid electrical shock or malfunctions in equipment.
5. The exhaust gases must be piped outside

Work Unit 1-9.

1. b.
2. c.
3. d.
4. a.

Work Unit 1-10.

1. NAVMC 10523 and 10524
2. Every time before you start the generator set
3. True
4. True
5. False

Work Unit 1-11.

1. a. Starting
b. Monitoring
c. Shutting down
2. remote
3. 30
4. c.
5. a.
6. b.
7. a.

Work Unit 1-12.

1. b.
2. a.
3. d.
4. c.

Work Unit 1-13.

1. First
2. (In any order) a. Inspection
b. Cleaning
c. Servicing
d. Lubricating
e. Adjustments

Work Unit 1-14.

1. (In any order) a. Engineer Equipment Operational Record (NAVMC 10523)
b. Engineer Equipment Operation Log and Service Record (NAVMC 10524)
2. Provides the operator with the authority to operate an item of equipment on an assigned mission.
3. Gives the operator authority to operate the generator set for extended periods of time.

STUDY UNIT 2

DEPARTMENT OF DEFENSE (DOD) SERIES GENERATORS

STUDY UNIT OBJECTIVE: UPON SUCCESSFUL COMPLETION OF THIS STUDY UNIT, YOU WILL BE ABLE TO IDENTIFY THE TYPES AND CAPABILITIES OF THE DOD DIESEL SERIES GENERATORS. YOU WILL ALSO BE CAPABLE OF INSTALLING, OPERATING, AND PERFORMING OPERATOR'S MAINTENANCE ON THE GENERATORS.

Work Unit 2-1. DESCRIPTION

NAME THE FIVE DOD DIESEL GENERATOR SETS. _____

STATE THE COMMON OUTPUT CAPABILITIES OF EACH TYPE OF DOD GENERATOR SET.

MATCH THE FIVE DOD GENERATOR SETS WITH THEIR APPROPRIATE KW RATING.

The DOD series generators include five units which the Marine Corps presently utilizes. These generators are identified by number instead of name. Listed below are the five DOD generators presently used:

MEP 005A

MEP 006A

MEP 007A

MEP 009A

MEP 115A

Although these generators differ in some ways, as will be discussed in this work unit, they are all a compact, transportable source of a.c. power. The generators offer 240/416 volts and 120/208 volts a.c. with a 3-phase, 4 wire connection. Each is driven by a water-cooled diesel engine.

The generators incorporate radio interference componentry to prevent interference with the load, as well as safety devices to protect the generator. However, the generators differ in some ways, and by comparing the capabilities listed in table 2-1, you should be able to see these differences.

Note: There are two general classifications of generator sets, Utility and Precise. "Utility" generator sets do not have close frequency and voltage regulation, and are used on loads where close regulation is not required (i.e. Lights). "Precise" generator sets, on the other hand, do have close voltage and frequency regulation, and are used on loads requiring close regulation (i.e. Communication equipment).

Table 2-1. Capabilities of DOD diesel Generator Sets

MEP	005A	006A/115A*	007A	009A
FUEL TANK CAPACITY	40 gals	55 gals	90 gals	240 gals
OIL CAPACITY	17 qts	20 qts	29 qts	42 qts
COOLANT SYSTEM CAPACITY	26 qts	33 qts	11 gals	24.25 gals
VOLTAGE OUTPUT	120/208	120/208	120/208	120/208
	240/416	240/416	240/416	240/416
FREQUENCY OUTPUT	50/60 Hz	50/60 Hz-400Hz*	50/60 Hz	50/60 Hz
KW RATING	30 KW	60 KW	100 KW	200 KW

*Note: The MEP 115A is a 60 KW/ 400 Hz "Precise" power generator

By using the data in 2-1, you should be able to see that all the DOD generators are basically the same as far as frequency and voltage are concerned (with the exception of the MEP 115A). However, they all differ in fuel, oil, and coolant capabilities and in KW ratings.

EXERCISE: Answer the following questions and check your responses against those listed at the end of this study unit.

1. List the five generators found in the DOD series.

a. _____
 b. _____
 c. _____
 d. _____
 e. _____

2. Which voltage output is common to all five DOD generator sets?

Note: Match each DOD generator listed in column 1 (items 3-6) with the appropriate KW rating listed in column 2 (a, b, c, d, e, or f).

<u>Column 1</u> <u>DOD generator</u>	<u>Column 2</u> <u>KW rating</u>
3. MEP 005A	a. 20 KW
4. MEP 006A	b. 30 KW
5. MEP 007A	c. 60 KW
6. MEP 009A	d. 80 KW
7. MEP 115A	e. 100 KW
	f. 200 KW

8. Which frequency output is common to four of the DOD generator sets?

Work Unit 2-2. INSTALLATION - UNCRATING

LIST THE TWO STEPS IN THE PROCEDURE FOR UNCRATING THE DOD GENERATOR SET.

NAME THE TWO TYPES OF EQUIPMENT THAT CAN BE USED WHEN UNLOADING OR MOVING DOD GENERATOR SETS.

LIST THE SEQUENCE IN WHICH THE TOP AND SIDES OF THE CRATE WILL BE REMOVED.

STATE THE DIFFERENCE IN UNCRATING PROCEDURE IF THE GENERATOR SET IS TO BE INSTALLED ON A PERMANENT OR TEMPORARY BASIS.

The first step for installing a generator for operation is unloading. This is done in the following manner.

- **Unloading equipment.** A crane, forklift, or similar lifting device should be used to unload the equipment. The equipment must be kept in the UP position while loading.

WARNING

Do not use a lifting device with a capacity of less than 10,000 pounds. Do not allow the generator set to swing while it is suspended. Failure to observe this warning may result in serious injury or death to personnel.

The second step in the procedure for uncrating the DOD generator set is the removal of the crate which is accomplished in the following manner.

- Removal of crate. Before unpacking, move unit as near as possible to the location where it will be operated.

CAUTION

Exercise care in the use of bars, hammers, and similar tools while uncrating unit to avoid damaging equipment.

Remove the top and then the sides of the crate (see figure 2-1). If the unit is to be mounted as a permanent installation, either inside or outside, remove unit from wood skid base. If the unit is to be set up as a temporary installation, do not remove the wood skid base. The wood skid base will serve as a foundation for the generator on soft ground, mud, or snow.

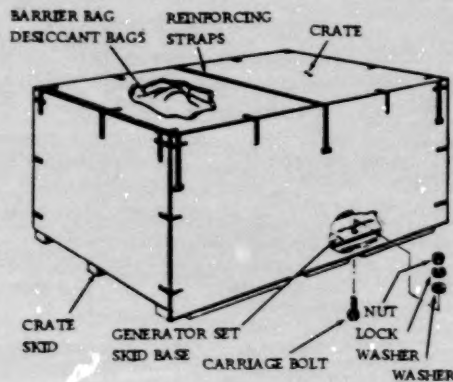


Fig 2-1. Shipping crate.

EXERCISE: Answer the following questions and check your responses against those listed at the end of this study unit.

1. List the two steps in the procedure for uncrating the DOD generator set.
a. _____
b. _____
2. Name the two types of equipment that can be used to unload and move DOD generators.
a. _____
b. _____
3. List the sequence in which the top and sides of the crate should be removed.
a. _____
b. _____
4. State the difference in the procedure for uncrating a DOD generator if it is to be installed on a permanent or on a temporary basis.

Work Unit 2-3. INSTALLATION - MOVING

DESCRIBE THE PROCEDURE FOR MOVING A DOD GENERATOR WITH A FORKLIFT.

DESCRIBE THE PROCEDURE FOR MOVING A DOD GENERATOR WITH A CRANE.

After the generator set has been uncrated, you may have to move it to another area. This can be accomplished by using the moving procedures and equipment listed below.

Equipment used to move the generator set. To move an unpacked generator set from one location to another, use a forklift truck with a minimum load rating of 10,000 pounds. You can also use an overhead crane with a minimum load rating of 10,000 pounds.

Moving the generator set. When using the forklift, use the openings in the skid base assembly of the generator set as shown in figure 2-2. Guide the forks into the opening provided, and continue to move the forklift forward until the generator set comes in contact with the lift frame of the forklift. Lift the generator set and proceed to the point of servicing.

When using an overhead crane to move a generator set you must lift it by both lifting eyes (fig 2-2). Attach a lifting device, similar to the one shown in figure 2-3, by engaging one hook in each lifting eye. You should then attach the ring of the lifting device to the lifting hook of the crane. Raise and lower the generator set slowly, manually stabilizing it to prevent it from rotating. Use this method of movement only for a very short distance or when removing the generator set from or placing it onto a transporter.

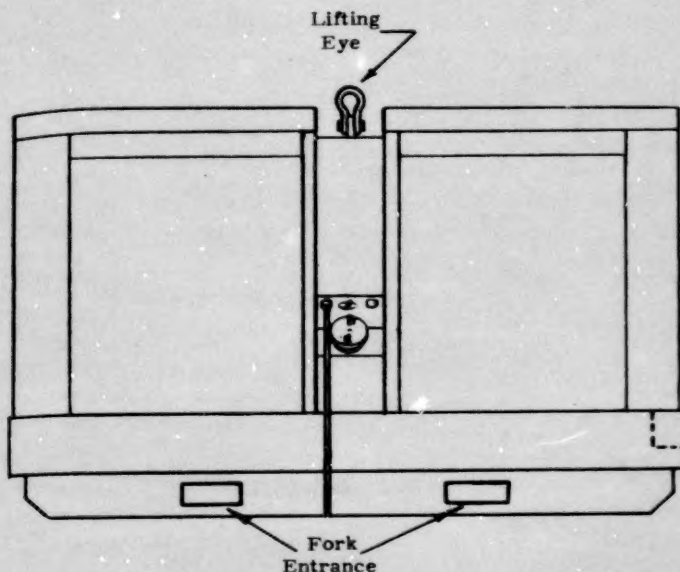


Fig 2-2. Generator with lifting eye and forklift opening.

Note: Always have a man guide the forklift driver. Make sure the forklift forks come through openings in skid base on other side of unit before lifting so not to damage bottom of unit.

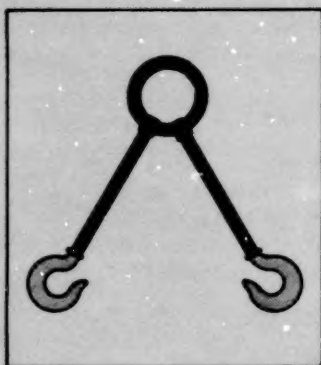


Fig 2-3. Lifting device.

EXERCISE: Answer the following questions and check your responses against those listed at the end of this study unit.

1. Describe the correct procedure for moving a DOD generator with a forklift.

2. Describe the correct procedure for moving a DOD generator with a crane.

Work Unit 2-4. INSTALLATION - INITIAL SERVICING

LIST THE THREE STEPS IN SERVICING THE RADIATOR.

LIST THE TWO STEPS IN SERVICING THE CRANKCASE.

LIST THE TWO STEPS IN SERVICING THE FUEL TANK.

LIST THE TWO STEPS IN SERVICING THE BATTERIES.

Now is the time when consumable materials (fuel, coolant, and lubricating oil) should be added. It is recommended that you use an antifreeze solution as a coolant even in warm weather. This is due to the rust inhibitor contained in the antifreeze, and because the antifreeze has a higher boiling point than water.

Before the addition of any of the consumable materials, you must insure that all the drain cocks are closed and the drain plugs are tight. After this is accomplished, you are ready to begin servicing the generator. You should be able to perform the initial servicing of the generator set by following the procedures listed below:

Radiator.

- Open radiator cap access door and remove radiator cap.
- Fill radiator with proper coolant until coolant level is two inches below filler mark.
- Fasten tag near radiator cap indicating type of coolant (water or antifreeze) and level of protection.

Engine crankcase.

- Remove engine lubricating oil filler cap and add oil as required to obtain full level on dip stick. Refer to figure 2-4 for proper lubricating oil.

CAUTION

The dip stick is shielded, and allows checking oil level while the engine is either stopped or running. The stick is stamped on both sides to indicate the two different oil levels. The engine running side is stamped: ADD, FULL, and RUNNING. The engine stopped side is stamped: ADD, FULL, and STOPPED. Use appropriate add and full marks dependent upon whether the engine is stopped or running. Insure that the appropriate side is up when inserting the gauge, since the under side will be wiped in the gauge tube radius when the gauge is removed, therefore indicating a false oil level reading.

Text continues on page 2-9.

LUBRICATION ORDER

LI-000388-12

L05-6115-545-12

(Supersedes L05-6115-545-12 dated 30 JUNE 1975)

**GENERATOR SET, DIESEL DRIVEN, 60 KW, 120/208-240/416V,
3 PHASE, 4 WIRE, 50-60 HERTZ, SKID MOUNTED, (TACTICAL
UTILITY) NSN 6115-00-118-1243 AND (TACTICAL PRECISE)
NSN 6115-00-118-1252 AND
GENERATOR SET, DIESEL DRIVEN, 60 KW, 120/208-240/416V,
3 PHASE, 4 WIRE, 400 HERTZ, SKID MOUNTED, (TACTICAL
PRECISE) NSN 6115-00-118-1253**

Reference: FEDERAL SUPPLY CATALOG C9100-11.

Intervals are based on normal hours of operation. Adjust to compensate for abnormal operation and severe conditions. Draining intervals provide sufficient lubrication must be performed for adequate preservation.

Clean parts with SOLVENT, drycleaning Type II (SD-2). Dry before lubricating.

Drain crankcase when hot. Fill and check level.

Relubricate after washing.

*The time specified are the times required to perform all services at the particular interval.

Clean fittings before lubricating.

* TOTAL MAN HR		* TOTAL MAN HR	
INTERVAL	MAN HR	INTERVAL	MAN HR
8	0.1	300	0.3
100	0.5	500	0.5

MOLD

MOLD

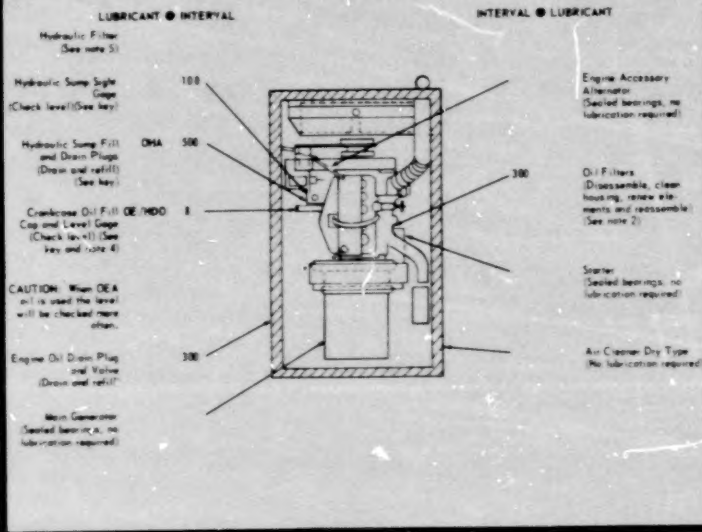


Fig 2-4. Lubrication order (sheet 1 of 2).

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KEY-					
LUBRICANTS	CAPACITY	EXPECTED TEMPERATURES			INTERVALS
		Above +32°F Above 0°C	+40°F to +10°F +5°C to -23°C	0°F to -45°F -18°C to -50°C	
DE-HDD-LUBRICATING OIL, Engine		DE-HDD 31	DE-HDD 10	DEA	Intervals given are in hours of normal operation.
Engine Crankcase	26 or (24.5L)				
Oil Can Plants					
DEA-LUBRICATING OIL, Engine, Arctic		ALL TEMPERATURES			
DHA-HYDRAULIC FLUID					
Hydraulic Pump	4 qt (3.8L)				

NOTES

1. FOR OPERATION OF EQUIPMENT IN PROTRACTED COLD TEMPERATURES BELOW -10°F. (-23°C). Remove lubricants prescribed in the key for temperatures above -10°F. (-23°C). Retain those with lubricants specified in the key for temperatures below -10°F. (-23°C).

2. OIL FILTER. After installing new filter elements, (a) crankcase, place dead crank switch (SZ) in the off (down) position and crank engine for 15 seconds, then return dead crank switch to the on (up) position. Start and operate engine 5 minutes, check filter housing for leaks. Stop engine, check crankcase oil level and bring to full mark.

3. LUBRICANTS. The following is a list of lubricants with the Military Symbols and the applicable specification numbers.
DE-HDD MIL-L-210-AC DEA MIL-L-46167
DHA MIL-H-560-B

4. CRANKCASE. Crankcase level may be checked with the engine in either a static or operating condition.

5. HYDRAULIC FILTER. (Tactical practice sets only) every 500 hours of operation disassemble hydraulic filter, remove element, and reassemble. Bring oil level to full, run for 15 minutes, check level and fill if necessary.

Copy of this Lubrication Order will remain with the equipment at all times, instructions contained herein are secondary.

BY ORDER OF THE SECRETARIES OF THE ARMY AND NAVY
BREIGHTON W. ABRAMS
General, United States Army
Chief of Staff

OFFICIAL
VERNE L. BOWERS
Major General, United States Army
The Adjutant General

A. R. WARSCHALL
Rear Admiral, CEC, USN
Commander, Naval Facilities
Engineering Command

Note: These lubricants are for 60 KW sets. Be sure to check TM for proper lubricant when dealing with other DOD generator sets.

Fig 2-4. Lubrication order (sheet 2 of 2), --continued.

- After adding oil, check crankcase lubricating oil level using proper side of engine dip stick.

Fuel tank.

- Remove fuel tank filler cap and fill fuel tank.

WARNING

Always maintain constant metal-to-metal contact between fuel tank filler neck and spout of fuel supply. This will prevent the possibility of sparking caused by static electricity.

- Replace filler cap and wipe up any spilled fuel.

Note: The generator set may need bleeding after initial servicing. Refer to the proper TM.

Batteries. The final step in the initial servicing of the generator is servicing the batteries and connecting them. The batteries are shipped dry. After obtaining some electrolyte, fill battery cells to slots in the cells with battery electrolyte. Install filler caps and rinse with water any spilled electrolyte on the battery and then connect the battery cables.

WARNING

Electrolyte contains sulfuric acid and can cause severe burns. Always dilute electrolyte with water, never water with electrolyte. Handle it with care. If the solution comes in contact with the body, eyes, or clothing, rinse immediately with clean water. Avoid spilling electrolyte on painted surfaces. Do not work alone or smoke when servicing batteries.

EXERCISE: Answer the following questions and check your responses against those listed at the end of this study unit.

1. List the three steps in servicing the radiator.

a. _____
b. _____
c. _____

2. List the two steps in servicing the crankcase.

a. _____
b. _____

3. List the two steps in servicing the fuel tank.

a. _____
b. _____

4. List the two steps in servicing the batteries.

a. _____
b. _____

5. The dip stick permits the level of oil to be checked when the unit is either stopped or running.

True _____

False _____

6. Metal-to-metal contact should be maintained when filling the fuel tank, because this will prevent sparking caused by _____.

Work Unit 2-5. INSTALLATION-SITING

DESCRIBE, IN GENERAL, WHAT A PROPER LOCATION WOULD BE TO PLACE A DOD GENERATOR SET.

LIST MAXIMUM DISTANCES FOR A DOD GENERATOR FROM (1) A PARALLELED GENERATOR, (2) AN AUXILIARY FUEL SUPPLY, (3) A REMOTE CONTROL AREA.

LIST THE TWO KEY FACTORS IN POSITIONING A GENERATOR FOR PERMANENT INSTALLATION.

STATE THE KEY FACTOR IN POSITIONING A GENERATOR FOR TEMPORARY INSTALLATION.

DESCRIBE A PROPERLY INSTALLED EXHAUST LINE FOR AN INDOOR GENERATOR.

The generator set is now ready for operation. The word comes down that you, as the operator, will take the generator to a specific area. After arranging for transportation of the generator set, you must go to the area where the generator will be set to select a proper site. When selecting this site you should keep in mind the following procedures.

Location. Locate the generator set on a level site, which is clear of obstacles and has ample ventilation. The site must be within 25 feet of any paralleled generator set, 25 feet of any auxiliary fuel supply, and 500 feet of any remote control area.

Note: The generator set is a portable unit and is designed to operate satisfactorily up to 15 degrees out of level. However, the unit should be as level as possible during operation.

Positioning. When preparing for permanent installation, be sure the base is solid enough to support the weight of the unit. Select a location where there will be sufficient space on all sides for servicing and operating the unit. When preparing for a temporary installation, move the generator set as close to the worksite as practical. Use suitable planks, logs, or other materials for a base in an area where the ground is soft.

Indoor installation. When operating the generator from an indoor installation you should keep the area well ventilated at all times. This will help provide the generator with a maximum supply of fresh air.

The exhaust line used to pipe the exhaust outside should be gastight and have a 4-inch inside diameter. Use as few bends as possible in the line from the generator to the outside. Metal shields should be provided for the exhaust line where it passes through flammable walls. Exhaust lines should be wrapped in asbestos if there is any danger of anyone touching them.

EXERCISE: Answer the following questions and check your responses against those listed at the end of this study unit.

1. Describe, in general, what a proper location would be to place a DOD generator set.

2. What is the minimum distance a generator can be placed from the following:
 - a. Paralleled generator _____
 - b. Auxiliary fuel supply _____
 - c. Remote control area _____
3. List two key factors in positioning a generator for permanent installation.
 - a. _____
 - b. _____
4. What is the key factor in positioning a generator for temporary installation?

5. Describe an exhaust line for an indoor generator.

Work Unit 2-6. INSTALLATION - GROUNDING

LIST, IN ORDER OF PREFERENCE, THE THREE ACCEPTABLE GROUNDING DEVICES.

DESCRIBE MINIMUM REQUIREMENTS FOR A GROUNDING ROD.

DESCRIBE MINIMUM REQUIREMENTS FOR A GROUNDING PLATE.

The generator set must be grounded prior to operation. The ground can be, in order of preference, an underground metallic water piping system, a driven metal rod, or a buried metal plate. A ground rod must have a minimum diameter of 5/8 inch if solid or 3/4 inch if pipe, and must be driven to a minimum depth of eight feet. A ground plate must have a minimum area of nine square feet and must be buried at a minimum depth of four feet. The ground lead must be at least No. 6 AWG (American Wire Gauge) copper wire and must be bolted or clamped to the rod, plate, or piping system. Connect the other end of the ground lead to the generator set ground terminal stud (figure 2-5). The following procedures are to be used to install grounding rods when required.

- Insert ground cable supplied with generator set, into slot in ground stud and tighten nut.
- Connect coupling to ground rod and install driving stud in coupling. Make sure driving stud is bottomed on ground rod.
- Drive ground rod into ground until coupling is just above the ground surface.
- After ground rods have been driven into the ground, remove driving stud and top coupling.
- Connect clamp and ground cable to top ground rod and secure by tightening screw.

WARNING

Do not operate the generator set unless ground terminal stud has been connected to a suitable ground. Electrical faults in the generator set, load lines, or load equipment can cause injury or electrocution from contact with an ungrounded system.

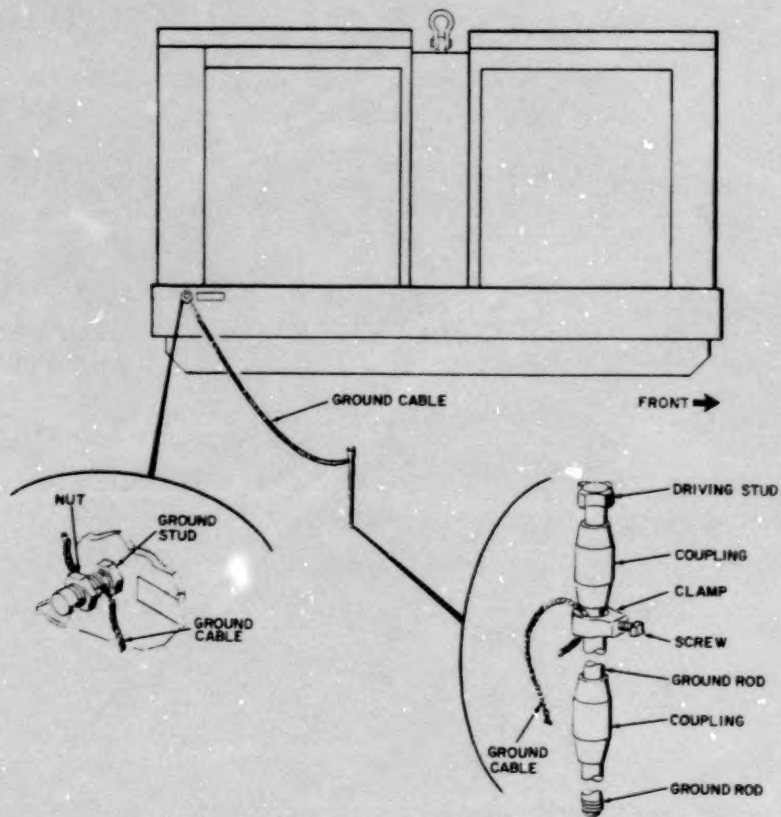


Fig 2-5. Grounding procedures.

EXERCISE: Answer the following questions and check your responses against those listed at the end of this study unit.

1. List in order of preference, the three acceptable grounding devices.

a. _____
 b. _____
 c. _____

2. Describe the minimum requirements for a grounding rod.

3. Describe the minimum requirements for a grounding plate.

4. The ground lead must be at least No. ____ AWG.

5. Where on the generator set should the ground lead be attached?

Work Unit 2-7. OPERATION - CONTROLS AND INDICATORS

GIVEN FIVE CONTROLS OR INDICATORS MATCH THEM WITH THEIR FUNCTION.

Prior to beginning operation of the unit, you should become familiar with the functions and locations of the controls of the generator set. By using table 2-2 and figure 2-6, you should have no problem identifying the functions of the controls or indicators and associating these with their location on the generator.

Table 2-2. Function of Controls, Instruments, and Receptacles

INDEX NUMBER	CONTROL, INSTRUMENT, OR RECEPTACLE	FUNCTION
1	Manual fuel shutdown lever (located on fuel injection pump housing)	Permits manual closing of engine fuel rack to shutdown engine.
2	Speed switch reset button (located on top of speed switch)	Permits resetting of engine overspeed switch after actuation.
3	Control cubicle control panel	Contains majority of generator set operating and monitoring controls.
4	Air cleaner condition indicator light	Illuminates to indicate dirty air cleaner panel filters.
5	Frequency meter	Indicates generator set frequency of voltage in hertz. On 50/60 hertz generator sets it is calibrated from 48 to 53 hertz for 50 hertz operation and 57 to 62 hertz for 60 hertz operation with scale divisions of 1/10 hertz. On 400 hertz generator sets it is calibrated from 388 to 412 cycles with scale divisions of 1/2 cycle.
6	Kilowatt meter (percent of power meter)	Indicates generator electrical power output. It is calibrated from 0 to 133 percent of power.
7	Ammeter-voltmeter selector switch	Selects current in each phase, three line-to-line voltage, and three line-to-neutral voltage for measurement by AC voltmeter and AC ammeter.
8	AC ammeter (percent of rated current meter)	Indicates percent of rated current per phase as selected by ammeter-voltmeter selector switch. It is calibrated from 0 to 133 percent of rated current with scale divisions of 2 percent.

Table 2-2. --continued.

INDEX NUMBER	CONTROL, INSTRUMENT, OR RECEPTACLE	FUNCTION
9	Panel lights	Illuminate control panel.
10	AC voltmeter	Indicates line-to-line and line-to-neutral voltages as selected by ammeter-voltmeter selector switch. It is calibrated from 0 to 500 volts with scale divisions of 5 volts.
11	Voltage adjust rheostat	Permits adjustment of generator set output voltage. Clockwise rotation increases voltage. It is rated at 0 to 250 $\pm$ 10 ohms.
12	Synchronizing lights	Indicates synchronization of frequency for paralleling of generator set.
13	Battle short indicator	Illuminates when battle short switch is in ON position.
14	Battle short switch and guard	Permits bypassing of all generator set faults except engine overspeed and short circuit for emergency operation. Guard prevents accidental switch actuation.
15	Mode selector switch	Permits selection of parallel or single unit operation. In parallel operation, activates all parallel circuits and synchronizing lights.
16	Voltage sensing switch	Permits selection of voltage regulator sensing and level adjusting circuits either at the set or a remote location.
17	Panel light switch	Energizes panel lights.
18	AC load contactor indicator	Illuminates when AC load contactor is closed.

Table 2-2--continued.

INDEX NUMBER	CONTROL, INSTRUMENT, OR RECEPTACLE	FUNCTION
19	AC load contactor switch	Permits opening and closing of AC load contactor.
20	Frequency adjust rheostat	Permits adjustment of generator set frequency on <u>precise</u> generator sets. Clockwise rotation increases frequency. It is rated at 0 to 500 ± 10 ohms.
21	Start-run-stop switch	Initiates start sequence and controls generator set operation.
22	Engine primer switch	Permits actuation of ether starting aid if start-run-stop switch is in START position.
23	Battery charging ammeter	Indicates battery charging current. Red indicates unsatisfactory, green satisfactory. It is calibrated from -10 to +20 amperes with scale divisions of 1 ampere.
24	Running time meter	Indicates operating time of generator set in hours and tenths up to 9999.
25	Fuel level gauge	Indicates level of fuel in fuel tank. It is calibrated from full to empty with scale divisions of 1/4 tank.
26	Coolant temperature gauge	Indicates engine coolant temperature in degrees F. Normal indication 180°F to 200°F. It is calibrated from 120°F to 240°F.
27	Oil pressure gauge	Indicates engine lubricating oil pressure in PSIG. Normal indication 40 to 60 PSIG. It is calibrated from 0 to 120 PSIG with scale divisions of 30 PSIG.

Table 2-2--continued.

INDEX NUMBER	CONTROL, INSTRUMENT, OR RECEPTACLE	FUNCTION
28	Fuse	Protects components of fault locator panel.
29	Reverse power indicator	Illuminates if power flow into generator set exceeds 20 percent of rated value.
30	Under voltage indicator	Illuminates instantaneously if voltage drops below 48 volts at generator coil T9-T12, or in 6 ± 2 seconds if voltage is between 65 to 99 ± 4 volts. Utilized on precise generator sets only. AC voltmeter indication: 120 single phase 48 to 99 ± 4 volts.
31	Short circuit indicator	Illuminates if output current in any phase exceeds approximately 425 ± 25 percent of rated current.
32	Overspeed indicator	Illuminates if engine RPM exceeds 2425 ± 25 RPM.
33	Low oil pressure indicator	Illuminates if engine oil pressure falls below 15 ± 3 PSIG.
34	Coolant temperature high indicator	Illuminates if engine coolant temperature exceeds $217^\circ \pm 3^\circ\text{F}$.
35	No fuel indicator	Illuminates if level of fuel in day tank falls to a point which will operate the set at rated load for one minute.
36	Overload indicator	Illuminates if current in any phase exceeds 110 percent of rated current on an inverse time principle.

Table 2-2--continued.

INDEX NUMBER	CONTROL, INSTRUMENT, OR RECEPTACLE	FUNCTION
37	Under frequency indicator	Illuminates if frequency drops to: 55 $\pm$ 1 hertz for 60 hertz operation, 46 $\pm$ 1 hertz for 50 hertz operation, and 370 $\pm$ 5 hertz for 400 hertz operation. Utilized on precise gen- erator sets only.
38	Over voltage indicator	Illuminates if voltage reaches 153 $\pm$ 3 volts at generator coil T9-T12. AC voltmeter indication 120 single phase 153 $\pm$ 3 volts.
39	Test or reset switch	Permits testing and resetting of fault locator panel indicators.
40	Plate	Covers opening provided for electric winterization kit control box.
41	Plate	Covers opening provided for fuel burning winterization kit control box.
42	DC control circuit breaker	Protects control circuits energized from batteries. Permits emer- gency stopping of generator set. It has a 7.5 ampere rating.
43	Manual speed control	Permits engine speed adjustment through action of utility governor. Rapid adjustment is made by depressing button and pulling out or pushing in control; pushing in on control increases speed. Fine adjustment is made by rotating vernier knob. Clockwise rotation of vernier will increase speed. Control should be in maximum fuel position on precise generator sets.

Table 2-2--continued.

INDEX NUMBER	CONTROL, INSTRUMENT, OR RECEPTACLE	FUNCTION
44 and 46	Parallel receptacles	Utilized to interconnect governors and exciter regulators for paralleling precise generator sets with parallel cable.
45	Shorting plug	Shorts pins C and D of parallel receptacle. Plug is removed to parallel precise generator sets and installed to parallel utility sets.
47	Protective caps	Protect receptacles from damage.
48	Plate and sleeve assembly	Covers opening provided for kit installation and entrance for load cable.
49	Plate	Covers opening provided for kit installation.
50	Circuit breaker (15 amperes)	Protects convenience receptacles.
51	Convenience receptacles	Provide 120 VAC at generator set operating frequency.
52	Air cleaner restriction indicator switch	Energizes panel mounted light when filters require service.
53	Fuel transfer valve	Permits selection of generator set tank or auxiliary fuel supply for operation.
54 and 55	Slave receptacles (SR1 and SR2)	Permit easy connection to batteries to supply or obtain 24 VDC.
56	Frequency selector switch	Permits selection of 50 or 60 hertz operation. Utilized on 50/60 hertz precise generator sets.
57	Radiator shutter manual control handle	Permits manual opening and closing of the radiator shutter when coolant is cold. When coolant is hot handle may be used for opening of shutter only.

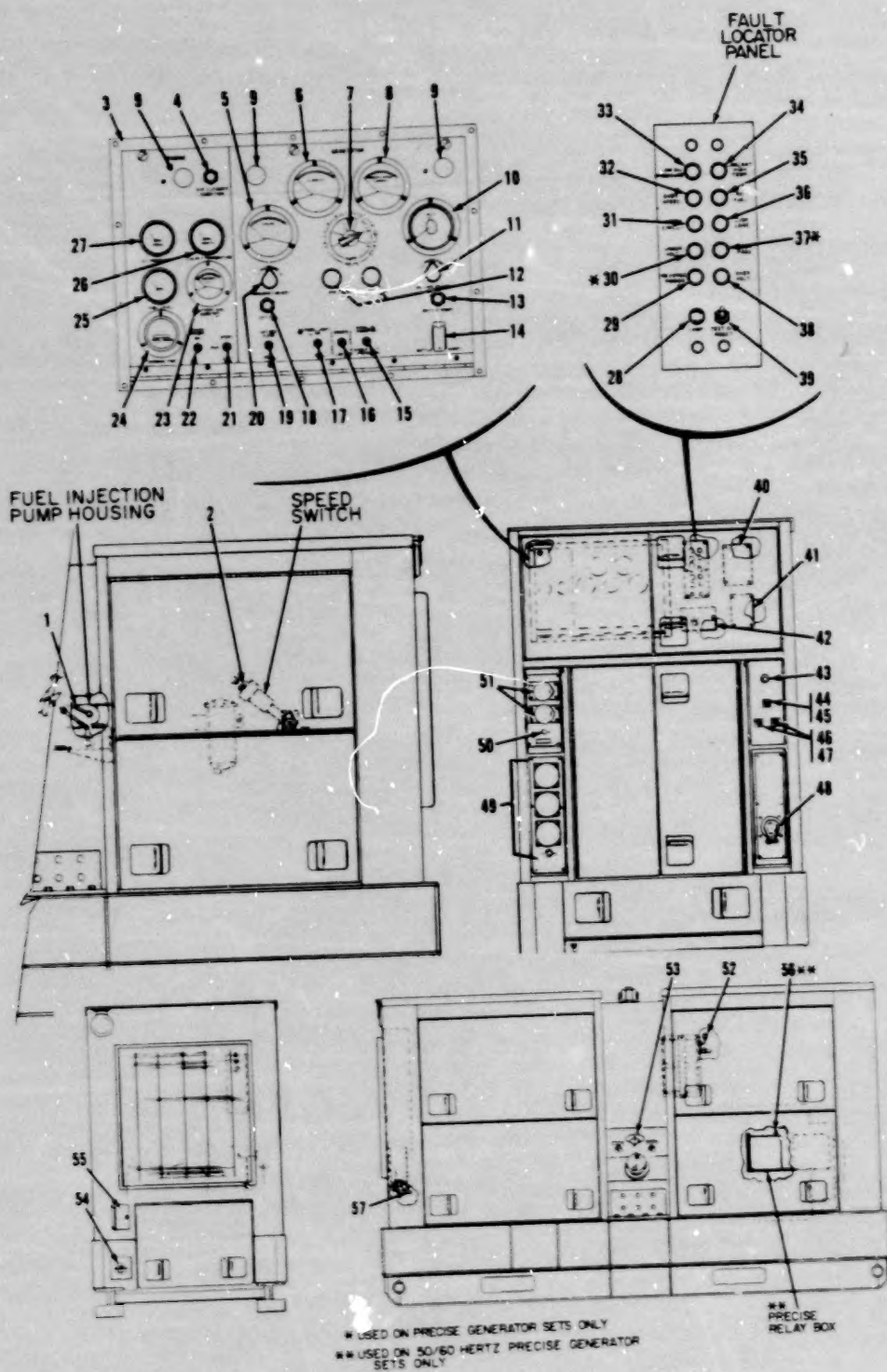


Fig 2-6. Location of controls, instruments, and receptacles.

Legend to figure 2-6.

Legend to figure 2-b

- | | |
|--|--|
| 1. Manual fuel shutdown lever | 29. Reverse power indicator |
| 2. Speed switch reset button | 30. Under voltage indicator |
| 3. Control cubicle control panel | 31. Short circuit indicator |
| 4. Air cleaner condition indicator light | 32. Overspeed indicator |
| 5. Frequency meter | 33. Low oil pressure indicator |
| 6. Kilowatt meter (percent of power meter) | 34. Coolant temperature high indicator |
| 7. Ammeter-voltmeter selector switch | 35. No fuel indicator |
| 8. AC ammeter (percent of rated current meter) | 36. Overload indicator |
| 9. Panel lights | 37. Under frequency indicator |
| 10. AC voltmeter | 38. Over voltage indicator |
| 11. Voltage adjust rheostat | 39. Test or reset switch |
| 12. Synchronizing lights | 40. Plate |
| 13. Battle short indicator | 41. Plate |
| 14. Battle short switch and guard | 42. DC control circuit breaker |
| 15. Mode selector switch | 43. Manual speed control |
| 16. Voltage sensing switch | 44. Parallel receptacle |
| 17. Panel light switch | 45. Shorting plug |
| 18. AC load contactor indicator | 46. Parallel receptacles |
| 19. AC load contactor switch | 47. Protective cap |
| 20. Frequency adjust rheostat | 48. Plate and sleeve assembly |
| 21. Start-run-stop switch | 49. Plate |
| 22. Engine primer switch | 50. Circuit breaker |
| 23. Battery charging ammeter | 51. Convenience receptacles |
| 24. Running time meter | 52. Air cleaner restriction indicator switch |
| 25. Fuel level gauge | 53. Fuel transfer valve |
| 26. Coolant temperature gauge | 54. Slave receptacle (SR1) |
| 27. Oil pressure gauge | 55. Slave receptacle (SR2) |
| 28. Fuse | 56. Frequency selector switch |
| | 57. Radiator shutter manual control handle |

EXERCISE: Match the function listed in column 1 (items 1-5) with the control, instrument, or receptacle listed in column 2 (a, b, c, d, e, or f). Check your responses against those listed at the end of this study unit.

Column 1

Functions

1. _____ Permits manual shutdown of engine
2. _____ Permits resetting of engine overspeed
3. _____ Initiates start sequence
4. _____ Indicates operating time in hours
5. _____ Indicates engine temperature in degrees F

Column 2

Controls, Instruments, or Receptacles

- a. Manual fuel shutdown lever
- b. Running time meter
- c. Coolant temperature gauge
- d. Start-run-stop switch
- e. Speed switch reset button
- f. Voltage sensing switch

Work Unit 2-8. OPERATION - SAFETY PRECAUTIONS

DESCRIBE THE CONDITION THE OPERATING AREA SHOULD BE KEPT IN WHEN OPERATING THE GENERATOR SET.

STATE HOW STATIC SPARKING CAN BE AVOIDED WHEN FUELING A GENERATOR.

STATE THREE SAFETY PRECAUTIONS TO BE USED WHEN CONNECTING LOAD CABLES TO A GENERATOR.

STATE WHY A GENERATOR SHOULD BE GROUNDED.

LIST THREE OPERATING SAFETY PRECAUTIONS.

Now that you are familiar with the controls and indicators, you are prepared to start the generator set. Before you do, you should insure that all safety precautions have been followed to insure the safety of personnel and equipment. Listed below are the safety precautions that should always be followed when working with diesel engine driven generator sets.

Condition of operating area. All personnel involved in the operation of the generator set should become familiar with the operating area and keep it dry or use insulating materials around the generator set to avoid the hazard of an electrical shock.

Filling fuel tank directly. When filling the fuel tank directly, always maintain a constant metal-to-metal contact between the fuel tank filler neck and the spout or nozzle to prevent sparking caused by static electricity.

Connecting load (power) cables. Before connecting the load cable to the generator set, make sure that the generator set is NOT connected in parallel to another generator set that is running, that it is NOT running, and that all switches are in the OFF or OPEN (deenergized) position.

Inspecting ground connection. Prior to starting the generator set, inspect the ground connection. Electrical defects in loadlines or load equipment can cause electrocution or severe burns when contact is made with an ungrounded system. Not grounding the set could cause malfunctions in the equipment being used.

Operation. Do not operate the generator set in an enclosed area unless the exhaust gases are piped to the outside. Continued breathing of exhaust fumes is dangerous. Do not inject ether into the engine manifold unless the engine is being cranked. Stay clear of all exposed electrical terminals when the generator set is operating.

Note: Remember, the use of safety precautions will protect your life as well as the lives of others.

EXERCISE: Answer the following questions and check your responses against those listed at the end of this study unit.

1. Describe the condition the operating area should be kept in when operating the generator set.

2. How can static sparking be avoided when fueling a generator?

3. What are three safety precautions that should be followed when connecting load cables to a generator.

a. _____
b. _____
c. _____

4. Why should a generator be grounded?

5. List three operating safety precautions.

a. _____

b. _____

c. _____

Work Unit 2-9. OPERATION - POWER CONNECTIONS

MATCH THE PROPER TERMINAL NUMBER WITH THE PROPER PHASE WHEN CONNECTING THE LOAD CABLES.

Now that the area is safe, you are ready to proceed to the connecting of the load cables. The cables should always be connected prior to starting the generator. The proper steps for connecting the cables are discussed below.

To connect the load cables to the generator set, refer to figure 2-7 and proceed as follows.

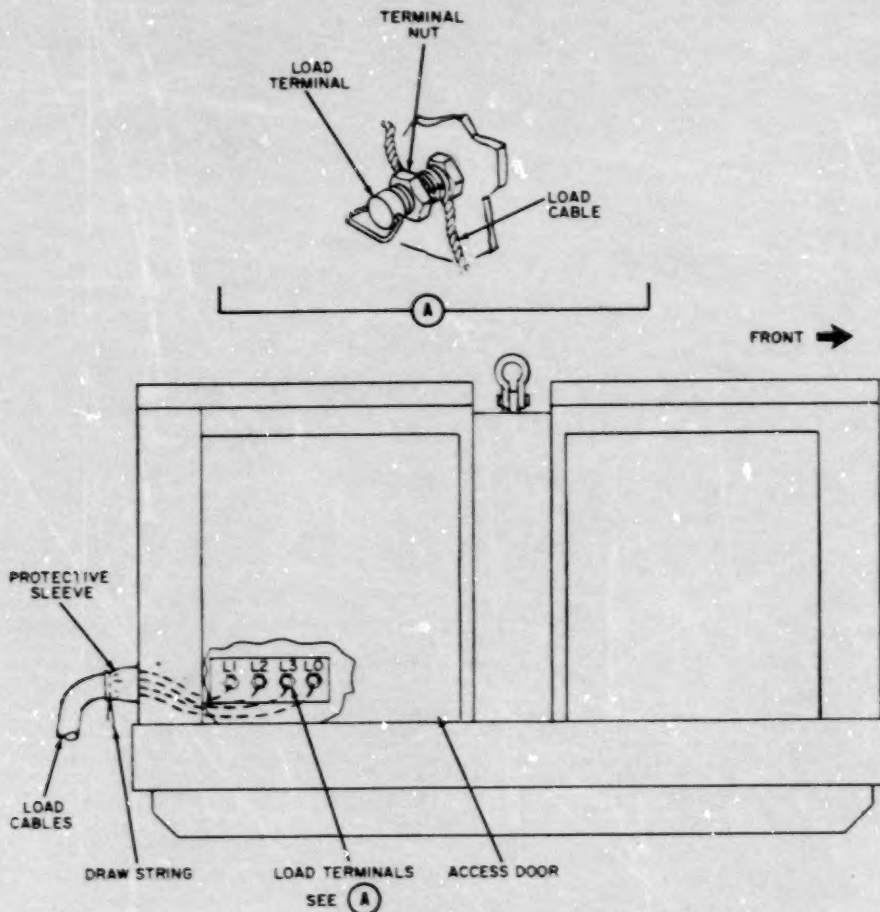


Fig 2-7. Load cable connections.

WARNING

Before attempting to connect load cables, make sure the generator set is not operating and there is no input to the load.

- Open access door and disconnect transparent cover by loosening six quick-release fasteners. Remove wrench from cover.

Note: Make sure proper phase relationship of load cables is maintained.

- Attach load cables in the following order: L0, L3, L2, and L1 as specified in the step below. The neutral cable must be connected to load terminal L0, load cable L1 to phase a, load cable L2 to phase b, and load cable L3 to phase c.
- Insert load cables through protective sleeve and attach cables to their respective load terminals, one cable to each terminal, by inserting cable in terminal slot and tightening terminal nut with wrench which was clipped to transparent cover. Install wrench on transparent cover and install cover.
- Tighten drawstring on protective sleeve to prevent entry of foreign matter.
- Close access door.

EXERCISE: Match the terminals listed in column 1 (items 1-4) to the proper phase listed in column 2 (a, b, c, d, or e). Check your answers with those listed at the end of this study unit.

Column 1

Terminal

1. L3
2. L2
3. L1
4. L0

Column 2

Phase

- a. Phase a
- b. Phase c
- c. Phase b
- d. Phase Neutral
- e. Phase d

Work Unit 2-10. OPERATION - PRESTART INSPECTION

NAME THE NAVMAC FORMS YOU CAN USE AS CHECKLISTS WHEN CONDUCTING A PRESTART INSPECTION.

You are now ready to begin the first step in starting the generator. This step is the prestart inspection. It consists in performing a series of checks, as provided by the NAVMC form 10523 or 10524, which is shown in table 2-3. By following the column marked "before operation" you should inspect everything required to be checked. At the end of this inspection the generator should be ready to start.

INTERVALS				INSPECTION	
BEFORE OPERATION	DURING OPERATION	AFTER OPERATION			
X			General	Make a visual inspection of the entire generator set for any obvious deficiencies, such as loose or missing bolts, nuts, and pins, and for bent, cracked, or broken parts. Inspect all wires and terminals for damage and loose connections.	
X			Fuel System	Wipe up any spilled lubricating or fuel oil.	
X	X			Inspect fuel system for leakage, condition of fuel lines, and integrity of fuel tank cap. See that tanks are full.	
X				Inspect for proper connection of auxiliary fuel supply and that screen on bottom of fuel drum adapter assembly is free of obstructions.	
		X	Engine	Inspect fuel pumps and system for leakage.	
X		X		Open drain valves on fuel tank, filters, and strainers and remove any water or sediment.	
X				Inspect engine mounts for security.	
X				Inspect engine air box drain cocks to make sure they are in the full open position and free of obstructions.	
X		X		Inspect oil in crankcase for proper level. If below proper level add oil as necessary.	
	X			Inspect for unusual noises or operation such as too much vibration, overheating, lack of power, oil leakage, excessive smoking, and engine failing to respond to the controls. Shut down the generator set under such conditions. Report deficiencies noted to proper maintenance personnel.	
X			Exhaust System	Inspect muffler for condition and security.	
X	X		Generator	For generator sets that are operating indoors, inspect exhaust extensions for condition, security, and leakage.	
X				Inspect generator screens for cleanliness.	
		X		Inspect generator attaching hardware for security.	
X			Control Panels	Inspect meter and gage faces for cleanliness.	
X				Inspect panel illumination lights for proper operation.	
	X		Cooling System	Inspect controls and indicators for proper operation (refer to table 3-1).	
X				Inspect radiator for proper coolant level. Add water or antifreeze as necessary.	
X				Inspect radiator cooling fins for obstructions.	
X	X		Batteries	Inspect cooling system for leakage.	
		X		Inspect radiator louver control valve for proper operation.	
X				Check fan belt for proper tension.	
X			Before Starting	Inspect battery electrolyte for proper level. Add distilled water as required.	
X				Inspect battery cables and terminals for corrosion and security.	
X				Inspect battery mount drain cock to make sure it is in the full open position and free of obstructions.	
X			Protection	Inspect generator set ground to make sure all connections are clean and tight.	
X				Inspect generator set to make sure it is free of tools, equipment, and personnel.	
X				Inspect load cables for security and proper connection.	
X				Make sure load contactor is in the open position.	
		X		Make sure all doors and panels are closed.	

EXERCISE: Answer the following questions true or false and check your responses against those listed at the end of this study unit.

1. What are the two NAVMC forms you can use as checklists when conducting a prestart inspection?

a. _____
b. _____

Note: Use table 2-3 in answering the following questions (3-5) true or false.

2. When making a prestart inspection, the load contactor switch should be in the closed position.

True _____ False _____

3. Prior to starting, you should inspect fuel pumps and systems for leakage.

True _____ False _____

4. When inspecting the engine during a prestart inspection, the air box drain cocks should be in the full open position.

True _____ False _____

Work Unit 2-11. OPERATION - OPERATING THE GENERATOR

LIST THE THREE PROCEDURES FOR OPERATING THE DOD GENERATOR SET.

MATCH SPECIFIC OPERATING STEPS FROM EACH PROCEDURE WITH THE CORRECT PROCEDURE.

Now that the generator is prepared to start, your next steps are to start the generator, monitor the generator while it is running, and shutdown the generator after operation is finished.

Starting procedures. To start the generator set, accomplish the following:

WARNING

Do not operate the generator set unless it is properly grounded. Electrical faults in generator set, load lines, or load equipment can cause injury or electrocutions from contact with an ungrounded system.

Note: The numbers in parenthesis refer to figure 2-6.

- Perform before operation checks and services as specified in table 2-3.
- Open control panel and air intake doors located at the rear of the generator set. Close other doors.
- Position mode selector switch to desired position and voltage, sensing switch (16) to LOCAL.
- Position voltage adjust rheostat to lower half of adjustment range.
- Depress button and pull out manual speed control (43) 1/4 to 1/2 way.
- Energize d.c. control circuit breaker (42) and position start-run-stop switch (21) to RUN.

- **Position fault locator switch (39) to TEST or RESET.** All fault locator panel indicators should illuminate; if not, check and replace defective lamp or fuse. Return switch to original position. All indicators except LOW OIL PRESSURE should go out. These indicators should go out as soon as the engine is started.

If **NO FUEL** indicator remains illuminated, day tank fuel level is below the no fuel shutoff point. Lift red guard and position battle short switch (14) to ON. When day tank is full, the electric fuel transfer pumps will change pitch indicating they are bypassing fuel internally. Position battle short switch and guard to OFF position.

If **COOLANT HIGH TEMP** indicator remains illuminated, engine coolant temperature is excessive and generator set should not be started until coolant cools off.

If **OTHER** indicators remain illuminated, report discrepancy to higher level of maintenance prior to starting.

- **Depress control cubicle indicators (4, 13, and 18, figure 2-6).** Indicators should illuminate and go out when released. If indicators do not illuminate, check and replace defective lamp.

If **battle short indicator (13)** remains illuminated, position battle short switch and guard to OFF position.

If **air cleaner condition** indicator (4) remains illuminated, refer to higher level of maintenance.

If **a.c. load contactor indicator (18)** remains illuminated, the a.c. load contactor is closed. Open load contactor. If load contactor can not be opened, refer to higher level of maintenance.

Position and hold **start-run-stop switch (21)** in start position until oil pressure increases to 25 psig and voltage builds up on a.c. voltmeter.

CAUTION

DO NOT CRANK ENGINE IN EXCESS
OF 15 SECONDS AT A TIME. ALLOW
STARTER TO COOL A MINIMUM OF
THREE MINUTES BETWEEN CRANK-
INGS.

- **Position start-run-stop switch (21) to RUN.**

Adjust voltage and frequency to desired setting.

- **Position load contactor switch (19) to closed position to supply power when required.**

Monitoring. After the generator set is running and the required power is being provided to the load, your job is still not over. You must insure that the generator continues to provide the required power to the load. By checking those items marked with an X in the "during operations" column (table 2-3), you can insure that the generator set will continue to perform efficiently.

Shutdown procedures. When you have accomplished your mission and there is no longer a need for your generator, you should begin shutdown procedures. Shutdown may be accomplished by following the procedures listed below.

- **Position and hold a.c. load contactor switch (19) to open until a.c. load contactor indicator (8) goes out.** Release switch.
- **Permit engine to operate at no load for approximately five minutes, to cool down.**
- **Position start-run-stop switch (21) to stop.**

- De-energize d.c. control circuit breaker (42).
- Perform after operations check as required in table 2-3.
- Close all generator set doors.

Note: In the event of an emergency, the generator set may be stopped by de-energizing the d.c. control circuit breaker.

EXERCISE: Answer the following questions and check your responses against those listed at the end of this study unit.

1. List the three procedures for operating the generator set.

- a. _____
- b. _____
- c. _____

Note: Match the operating step listed in column 1 (items 2-6) with the correct procedure in column 2 (a, b, or c).

Column 1	Column 2
<u>Operating Step</u>	<u>Procedure</u>
2. Permit engine to run approximately five minutes to cool down	a. Starting procedure
3. Inspect controls and indicators for proper operation	b. Monitoring
4. Energize d.c. control circuit breaker	c. Shutdown procedure
5. Position a.c. load contractor to open	
6. Inspect oil crankcase for proper level	
7. Pull manual speed control out 1/4 to 1/2 way	
8. When cranking the engine, do not crank it in excess of _____ seconds at one time.	
a. 3	c. 10
b. 5	d. 15

Work Unit 2-12. OPERATION - OPERATING UNDER UNUSUAL CONDITIONS

NAME THE EIGHT UNUSUAL CONDITIONS A GENERATOR MAY BE OPERATED UNDER.

STATE WHAT SPECIAL MAINTENANCE IS PERFORMED ON THE GENERATOR IN DIFFERENT UNUSUAL CONDITIONS.

You should now be familiar with starting and operating the generator set under normal conditions. However, the occasion may arise when you will need to be familiar with the operation of the generator set under unusual conditions. Listed below are a few of the unusual conditions you may encounter and the measures you should take to insure proper operation.

Operation under emergency conditions (battle short). The generator set protective devices may be bypassed and generator set operated under abnormal conditions. Operation under this condition will lock-out all protective devices with the exception of engine, overspeed, and short circuit.

Note: Battle short indicator (13, figure 2-6) will illuminate when battle short switch is positioned to ON and will remain illuminated until switch is positioned to OFF.

To start and operate a generator set that has been shutdown due to a fault, start generator as specified, except as soon as engine starts, with start-run-stop switch in START position, lift red battle short switch guard (14, figure 2-6) and position battle short switch to ON. Position start-run-stop switch to RUN.

To bypass a generator fault with engine still operating, lift red battle short switch guard (14) and position battle short switch to ON. Position a. c. load contactor switch (19) to CLOSE.

CAUTION

After operating generator set when battle short switch is used to override an activated protective device, inspect generator set for possible defects. Correct fault and any damage prior to next operation of generator set.

Operation in extreme cold (below -25° F). The generator set is designed to operate in temperatures of 25° F to 125° F without external heat. To operate the generator set from -25° F to -65° F winterization kits must be utilized.

- Fuel system. Keep fuel tank as full as possible to prevent condensation of moisture. Be sure to use proper grade of fuel for existing ambient temperature. Drain water and sediment from fuel system components more frequently than usual. Remove ice, snow, and moisture from area of fuel filler cap and filler neck.

CAUTION

If water is added to batteries in freezing temperatures, charge batteries or run engine for at least an hour to thoroughly mix water with electrolyte.

- Engine electrical system. Clean batteries and cables. Inspect batteries for cracked or damaged cases. Make sure that battery electrolyte level is to filler slot in each cell; that battery cap vent holes are open; and that battery terminals are tight and lightly greased. Keep batteries fully charged. Inspect all electrical wiring for cracks, breaks, and fraying of insulation. Tighten loose connections.
- Cooling system. Inspect level of coolant in radiator. Inspect cooling system for leaks, paying particular attention to gaskets and hose connections. Make sure that antifreeze solution is correct for lowest ambient temperature expected.
- Engine. Permit engine to reach normal operating temperature before applying load.

Operation in extreme heat.

- Cooling system. Check coolant level of radiator daily and add clean fresh water as necessary. Check radiator to see that there are no obstructions in the cooling fins. Check for leaks, and if necessary, use an approved rust inhibitor to prevent formation of rust and scale. Make sure radiator shutter control valve is operating properly.
- Fuel system. Keep fuel tank full to prevent condensation, but allow sufficient space for expansion of fuel.
- Batteries. Inspect the electrolyte level in the batteries daily. The electrolyte level should be to the slots in the filler wells. Service batteries as necessary.

- Generator. Keep the generator free of dirt and grime. Be sure that ventilating screens and louvers are free of obstructions which may restrict air flow.
- Engine. After removal of load, permit engine to run at no load a minimum of five minutes to cool engine prior to shutdown.

Operation in dusty or sandy areas.

- Protection. Keep all access doors and panels closed when generator set is not operating.
- Cooling system. Inspect cooling system for leaks. Keep radiator cap on tight. Keep radiator cooling fins clean.
- Lubrication. In sandy or dusty areas, lubricating oil filters must be serviced more frequently than under normal conditions. Clean all lubrication points before and after lubrication. Be sure that all lubrication containers are tightly sealed and stored in an area as free as possible from dust and sand.
- Fuel system. Take all necessary precautions to keep dust, sand, and grit out of fuel tank. Service fuel filters and strainers more frequently than normally required.

Operation under rainy or humid conditions.

- Fuel system. Keep fuel tank full to prevent condensation of moisture. Drain water and sediment from fuel system components more frequently than usual.
- Rust prevention. Clean generator set, inspect painted surfaces for cracks, peeled or blistered paint. Repair defects and repaint surfaces.

Operation in salt water areas.

- Cleaning. Clean the generator set frequently.
- Protection. Keep all access doors and panels closed when generator set is not operating. Remove rust immediately and apply paint and/or rustproofing material as applicable.

Operation in snow.

- Cooling system. Make sure radiator cooling fins and louvers are free of ice and snow before starting generator set.
- Protection. Keep all access doors and panels closed when generator set is not operating. Remove rust immediately and apply paint and/or rustproofing material as applicable. Remove snow from generator set before opening access panel and doors.
- Before starting. Remove snow from rear of generator set to prevent snow from being drawn into generator set.

Operation at high altitudes. The generator set is designed to operate at rated load at elevations up to and including 5,000 feet above sea level, 96.5 percent of rated load at 6,000 feet, and 90 percent of rated load at 8,000 feet, without special adjustments.

- Ventilation. Make sure there is adequate cooling airflow as the engine is more likely to overheat at high altitudes.
- Cooling system. Inspect level of coolant in radiator and make sure that the anti-freeze solution is correct for the lowest ambient temperature expected.
- Fuel system. Keep fuel tank as full as possible to prevent condensation of moisture. Be sure to use proper grade of fuel for existing ambient temperature.

EXERCISE: Answer the following questions and check your responses against those listed at the end of this study unit.

1. Name eight unusual conditions a generator may be operated under.
 - a. _____
 - b. _____
 - c. _____
 - d. _____
 - e. _____
 - f. _____
 - g. _____
 - h. _____
2. When operating with the battle short on, all protective devices will be locked out except the
 - a. over voltage.
 - b. under frequency.
 - c. overload.
 - d. engine overspeed and short circuit.
3. To prevent condensation of moisture when operating in extreme cold or rainy conditions, the fuel tank should be kept
 - a. completely full.
 - b. 3/4 full.
 - c. 1/2 full.
 - d. empty.
4. When operating in extreme heat, the coolant level of the radiator should be checked
 - a. hourly.
 - b. daily.
 - c. weekly.
 - d. monthly.
5. Which area(s) require(s) that lubricating oil filters and fuel filters be serviced more frequently than normal?

6. Under which conditions should you drain water and sediment from fuel system components more frequently than normal?

7. What is an important consideration when checking the antifreeze in areas of high altitude or extreme cold (below -25° F)?

8. When operating in salt water areas, the generator should be cleaned frequently.
True _____ False _____
9. Before starting the generator in snow, you should first remove snow from rear of generator.
True _____ False _____
10. The generator is designed to operate at rated load at elevation up to and including 8,000 feet above sea level.
True _____ False _____

Work Unit 2-13. OPERATOR'S MAINTENANCE

LIST THE FIVE ITEMS OF OPERATOR'S MAINTENANCE.

NAME THE THREE SYSTEMATIC INSPECTIONS PERFORMED ON THE GENERATOR.

Operator's Maintenance. If you do not take proper care of your body, chances are that you will become sick. You might even have to go to the hospital, resulting in you being out of circulation for a while. The same thing will happen to the generator set for which you are responsible if you do not take proper care of it. In fact, improper operator's maintenance may result in a generator set being permanently deadlined. In previous work units you have covered the generator set, now, after you have read and studied this work unit, you should be able to perform operator's maintenance to insure the proper operation of the generator. The operator is permitted to perform only 1st echelon maintenance, and this consists of the five items discussed below.

- Inspection. The generator set should be inspected systematically before, during, and after operation. This allows for defects to be discovered and corrected before they result in damage or failure of the generator to operate properly. The necessary preventive maintenance services should be performed before operation, and any defects noted should be corrected prior to starting. Defects discovered during the operation of the generator should be noted for correction as soon as the generator has ceased operation. Stop operation immediately if a deficiency is noted during operation since it would damage the equipment if operation were to continue. After-operation services should be performed after the unit has stopped for a day. Defects or unsatisfactory operating characteristics beyond the scope of the operator should be reported to proper maintenance personnel. Table 2-3 lists the operator's inspection requirements and when they should be performed.
- Cleaning. To prevent the buildup of pollutants which could cause damage to operating components or systems of the generator set, the generator set should be cleaned periodically. This is a responsibility of the operator. Cleaning operations should be performed only on the generator sets that are not operating or not connected in parallel with another generator set. Painted metal surfaces should be washed with a mild soap-water solution, rinsed with clear water, and wiped with a clean, dry, lint-free cloth. Hard incrustations of dirt may be scrubbed off with a bristly brush that has been dipped in a dry cleaning solvent such as federal specification P-S-661. The scrubbed area should then be rinsed with clear water. Linkages and control rods should be cleaned with the same type of dry cleaning solvent as above and dried with a clean, lint-free cloth. Remove any dust, dirt, or sand from the inside of the generator set with a damp, lint-free cloth. Remove corrosion from the battery terminals, cables, and hold-down frames with a wire brush.
- Servicing. To extend the operating life of the generator set, certain components have to be serviced on a regular basis. You, as the operator, will assist the maintenance mechanic in this servicing. Some of these components are the oil filters, air cleaner filters, fuel transfer pumps, and other items found on the quarterly PM sheet. Remember, servicing these components is not within the responsibility of the operator and must be done under the supervision of qualified maintenance personnel.

Note: Replenishing consumable materials (fuel and lubricants) is an important part of servicing equipment.

- Lubricating. Another responsibility of the operator is to lubricate the generator set at proper intervals. This should extend the operating life of the components of the generator set. Under normal conditions, change the engine oil every 100 operating hours. Lack of lubrication can cause serious damage to the engine. Refer to the lubrication order for the particular type of generator set you have to determine the type and quantity of lubricants required. The TM should indicate filling and drain points. Keep all lubricants (grease and oil) in closed containers and store them in a clean, dry place away from the heat. Do not permit dust, dirt, water, or foreign matter to mix with the lubricant. Operate the engine immediately after lubricating it and check for leaks.

- Adjustments. During generator set operation, if it is found that the frequency or voltage outputs are over or under their rated values, they must be adjusted. Adjust the frequency by turning the manual speed control (on Precise sets use the Frequency Adjust Knob), either clockwise or counterclockwise depending on whether you want to increase or decrease frequency of the generator. Adjust voltage by using the voltage adjust rheostat and turning either clockwise or counterclockwise depending on whether you want a decrease or an increase.

Note: If the adjustments do not bring the outputs to the required value, shutdown the generator and contact proper maintenance personnel.

EXERCISE: Answer the following questions and check your responses against those listed at the end of this study unit.

1. List the five items of operator's maintenance.

a. _____
b. _____
c. _____
d. _____
e. _____

2. Name the three systematic inspections performed on the generator.

a. _____
b. _____
c. _____

3. The operator is responsible for insuring that the generator is lubricated at proper intervals.

True _____

False _____

4. If during generator set operation, you find that the voltage or frequency outputs are over or under the rated value, you as operator may make the adjustments.

True _____

False _____

Work Unit 2-14. FORMS AND RECORDS

NAME THE TWO FORMS AND RECORDS USED BY THE OPERATOR WHILE OPERATING THE GENERATOR.

STATE THE PURPOSE OF THE NAVMC 10523 AND NAVMC 10524.

Forms and records. The operator is responsible for performing routine preventive maintenance on the generator set assigned to him. He is also responsible for entering the required data on the applicable forms. The forms which will be covered here are also a means for recording the hours that the generator set has been in operation so that preventive maintenance may be scheduled and fuel consumption determined.

- Engineer Equipment Operational Record, NAVMC 10523 (figs 2-8 and 2-9). The purpose of this form is to provide the operator with the authority to operate an item of equipment on an assigned mission. It also provides the operator with a list of the required scheduled maintenance services to be completed, as well as serving as a daily preventive maintenance checklist for the operator. Certain blocks on this form are filled out by the dispatcher before he gives the form to the operator (these blocks are marked with asterisks "*" as in figure 2-8). The operator fills out the blocks pertaining to operation and maintenance of the generator set while it is under his control (these blocks are marked with "Y" as in figure 2-8). Before leaving the equipment pool, the operator performs his before-operation services as indicated on the operational record (fig 2-9) and in the appropriate TM. If the dispatcher has indicated that other services are due, such as oil change, lubrication service, or other scheduled preventive main-

tenance, the operator must make sure that these services are performed and inserts the appropriate entries on the NAVMC 10523 and initials each block containing a checkmark to indicate that these services have been performed. While operating the generator set, the operator checks his during-operation services as indicated on the form and in the appropriate TM. After the job has been completed, the operator obtains a signature of release, on the form, from the job supervisor. Upon returning to the equipment pool, the operator services the generator set and performs the after-operation PM services as indicated on the form and in the appropriate TM. After all of the appropriate entries have been made and all required services performed, the operator returns the NAVMC 10523 to the dispatcher. If at any time while the generator set is under his control, the operator notices a discrepancy, he should make a note in the remarks column of the form.

DATE 3/2/8 * EQUIPMENT Generator SET (800) 40-7216 * U.S. OR SERIAL NO. 433712 ORGANIZATION 5th SFGT Ck *

OPERATIONAL	1ST OPERATOR	TIME	HOURS OR MINUTES	REPORT TO (Company)	RELEASED BY (Personnel - Time)
	<u>Cal Thorne</u> Y	IN <u>2440</u>	STOP <u>303</u>	<u>Mgt Academy</u>	<u>Mgt Melching</u>
	DISPATCHER'S SIGNATURE	OUT <u>1800</u>	START <u>278</u>	<u>Butler Blvd</u>	<u>2315</u>
	<u>Sgt Montgomery</u> *	TOTAL <u>6</u>	TOTAL <u>5</u>	<u>construction site</u>	
	2ND OPERATOR	IN	STOP		
	DISPATCHER'S SIGNATURE	OUT	START		
	TOTAL	TOTAL			
WORK PERFORMED	1ST OPERATOR <u>Cal Thorne</u> Y	Power for new building Y			
		2ND OPERATOR			

SERVICE	FUELS	LUBES	OIL CHANGE	LUBRICATION		PW SERVICE	
	EXHAUST GAS (CAL) (GAL)	OE (QTZ)	CO (QTZ)	HOUR/MILE DUE	HOUR/MILE COMPLETED	HOUR/MILE DUE	HOUR/MILE COMPLETED
	<u>30</u>	<u>2</u>	<u>400</u> *	Y	*	Y	Y
REMARKS	1ST OPERATOR'S SIGNATURE <u>Cal Thorne</u> Y 2ND OPERATOR'S SIGNATURE EQUIPMENT ADMINISTRATOR'S SIGNATURE <u>Mgt Melching</u>						

ENGINEER EQUIPMENT OPERATIONAL RECORD (1) (2) (3) (4) (5) (6) (7) (8) (9) (10) (11) (12) (13) (14) (15) (16) (17) (18) (19) (20) (21) (22) (23) (24) (25) (26) (27) (28) (29) (30) (31) (32) (33) (34) (35) (36) (37) (38) (39) (40) (41) (42) (43) (44) (45) (46) (47) (48) (49) (50) (51) (52) (53) (54) (55) (56) (57) (58) (59) (60) (61) (62) (63) (64) (65) (66) (67) (68) (69) (70) (71) (72) (73) (74) (75) (76) (77) (78) (79) (80) (81) (82) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92) (93) (94) (95) (96) (97) (98) (99) (100)

Fig 2-8. Engineer Equipment Operational Record (front).

UNIT "F" PG THREE						
Logistical for mission						
A - Adjunct		B - Recruit		X - Adjunct/Recruit Reported		
C - Check		V - Varsity		D - Defect/Converted		
L - Liberate		- Not applicable				
ITEM	DESCRIPTION	ARMED	ARMED	ARMED	2 WEEK	10 WEEK
1	GENERAL MATERIAL LOAD					
2	LOCAL GENERAL					
3	TRAIL, AIR, GROUND					
4	GENERAL WEAPONRY					
5	PERSONNEL					
6	SAFETY WEAPONRY					
7	TRAIL AND EQUIPMENT					
8	PERSONNEL					
9	CLARITY					
10	OPERATIONS					
11	GENERAL OPERATIONS					
12	GENERAL WEAPONRY					
13	LOCAL AND GROUND					
14	TRAIL					
15	SAFETY WEAPONRY					
16	SAFETY GUN (GUN)					
17	PERSONNEL					
18	PERSONNEL					
19	PERSONNEL					
20	TRAIL					
21	TRAIL					
22	TRAIL					
23	TRAIL					
24	TRAIL					
25	TRAIL					
26	TRAIL					
27	TRAIL					
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74	TRAIL					
75	TRAIL					
76	TRAIL					
77	TRAIL					
78	TRAIL					
79	TRAIL					
80						

- * Load contactor should be in the open position

Fig 2-9. Engineer Equipment Operational Record (reverse).

- [illegible]

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Answers to Study Unit #2 Exercises

Work Unit 2-1.

1. MEPS 005A, 006A, 007A, and 009A MEP 115A.
2. 120/208, 240/416 volts
3. b.
4. c.
5. e.
6. f.
7. C
8. 60 Hz

Work Unit 2-2.

1. a. Unloading equipment
b. Removal of crate
2. a. crane
b. forklift
3. a. top
b. sides
4. a. On a permanent basis the wood skid base is removed from the generator, and on a temporary basis the wood skid base remains bolted to the generator.

Work Unit 2-3.

1. Guide the forks of the forklift into the openings provided on the generator. Move the forklift forward until the generator set comes in contact with the lift frame of the forklift. Raise generator and move to desired location.
2. Engage one hook in each lifting eye, attach ring of lifting device to lifting hook of the crane. Raise generator and move to desired location.

Work Unit 2-4.

1. a. Open radiator cap access door and remove cap.
b. Fill radiator with proper coolant until coolant level is two inches below filler mark.
c. Fasten tag near radiator cap indicating type of coolant (water or antifreeze) and level of protection.
2. a. Remove engine oil filler cap and add oil to obtain full level.
b. Check crankcase oil level using proper side of engine dip stick.
3. a. Remove fuel tank filler cap and fill tank.
b. Replace filler cap and wipe up any spilled fuel.
4. a. Fill battery cells to slots with battery electrolyte.
b. Install filler caps and rinse spilled electrolyte with water.
5. True
6. static electricity

Work Unit 2-5.

1. Locate the generator on a level site, which is clear of obstacles and has ample ventilation.
2. a. 25 feet
b. 25 feet
c. 500 feet
3. a. A base solid enough to support weight of generator.
b. Sufficient space on all sides for servicing and operation.
4. Place set as close to worksite as practical.
5. The exhaust line should be gastight and have a 4-inch inside diameter.

Work Unit 2-6.

1. a. Underground metallic water piping system
b. Driven metal rod
c. Buried metal plate
2. A ground rod must have a minimum diameter of 5/8 inch if solid or 3/4 inch if pipe, and must be driven to a minimum depth of eight feet.
3. A ground plate must have a minimum area of nine square feet and must be buried at a minimum depth of four feet.
4. 6
5. Ground terminal stud

Work Unit 2-7.

1. b.
2. f.
3. e.
4. c.
5. d.
6. a.

Work Unit 2-8.

1. Keep area dry or use insulating materials around the generator set
2. Maintain a constant metal-to-metal contact between the fuel tank filler neck and the spout.
3. a. The generator should not be connected in parallel to another set that is running
b. The set should not be running.
c. All switches should be in the OFF or OPEN position.
4. To avoid electrical shocks or malfunctions in the equipment
5. a. Do not operate generator in enclosed area unless exhaust piped outside.
b. Do not inject ether into engine manifold unless engine is being cranked.
c. Stay clear of all exposed electrical terminals when generator is operating.

Work Unit 2-9.

1. b.
2. c.
3. a.
4. d.

Work Unit 2-10.

1. a. NAVMC 10523
b. NAVMC-10524
2. False
3. True
4. True

Work Unit 2-11.

1. a. Starting
b. Monitoring
c. Shutdown
2. c.
3. b.
4. a.
5. c.
6. a.
7. a.
8. d.

Work Unit 2-12.

1.
 - a. Under emergency conditions (battle short)
 - b. Extreme cold
 - c. Extreme heat
 - d. Dusty or sandy areas
 - e. Rainy or humid conditions
 - f. Salt water areas
 - g. Snow
 - h. High altitudes
2. d.
3. a.
4. b.
5. Sandy or dusty
6. Extreme cold, rain, or dust
7. Make sure antifreeze is correct for lowest temperature expected.
8. True
9. True
10. False

Work Unit 2-13.

1. (In any order)
 - a. Inspection
 - b. Cleaning
 - c. Servicing
 - d. Lubricating
 - e. Adjusting
2.
 - a. Before
 - b. During
 - c. After
3. True
4. True

Work Unit 2-14.

1. (In any order)
 - a. Engineer Equipment Operational Record (NAVMC 10523)
 - b. Engineer Equipment Operation Log and Service Record (NAVMC 10524)
2. Provides the operator with the authority to operate an item of equipment on an assigned mission.
3. Gives the operator authority to operate the generator set for extended periods of time.
4. dispatcher.

STUDY UNIT 3

SAFETY

STUDY UNIT OBJECTIVE: UPON SUCCESSFUL COMPLETION OF THIS STUDY UNIT, YOU WILL BE ABLE TO IDENTIFY THE SAFETY PRECAUTIONS YOU MUST TAKE TO AVOID ELECTRICAL SHOCK. SHOULD ELECTRICAL SHOCK OCCUR, YOU WILL BE ABLE TO TREAT THE VICTIM BY FOLLOWING THE FIRST AID PROCEDURES INCLUDED IN THE STUDY UNIT.

Work Unit 3-1. SAFETY PRECAUTIONS

LIST THREE MEANS BY WHICH ELECTRICAL SHOCK CAN BE AVOIDED.

This study unit will cover some precautions that could prevent injury or even death from electrical shock. There are several ways to receive electrical shock. This study unit will cover three of the most common ones.

● Assume all equipment is "HOT." The term "hot" is used to signify that an electrical conductor or apparatus is connected in such way that an electrical current flows through it. "Hot" may also signify that a circuit is closed and is electrically charged. When dealing with a circuit or piece of equipment, the best possible way to insure that a circuit is not "hot" is to shut it off yourself and make sure you mark it, so no one will come along and flip it back on. By following the rule that everything is "hot" until you personally turn it off, you can protect your life as well as the lives of others.

● Insure equipment is GROUNDED. Whenever you are working on any type of electrical equipment, this equipment should be grounded (fig 3-1). If it is not grounded, the equipment should not be operated, since it is unsafe for you and any others who may venture to use it.

Note: Generators must be grounded, before anyone may operate them.



Fig 3-1. Ground the generator set.

- Pay attention; "don't clown around."

Perhaps one of the most common causes of accidental injuries which kill or maim is something of which everyone is guilty of at one time or another; "clowning around." Whenever people start to "clown around" it usually starts out as fun, but quite often, ends up in tragedy (fig 3-2). To prevent this type of accident from occurring, you should use self-discipline when working in areas where injury may occur.

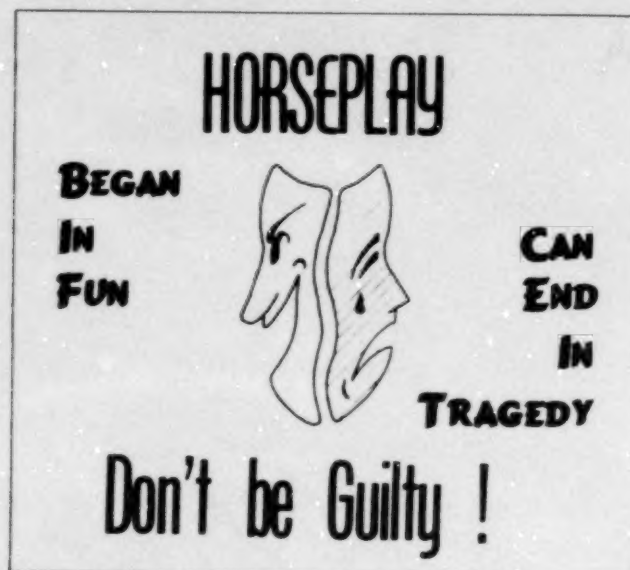


Fig 3-2. "Don't clown around."

By keeping in mind the three precautions discussed above and the safety program in your shop, you can help prevent accidents.

EXERCISE: Answer the following questions and check you responses against those listed at the end of this study unit.

1. List the three precautions you should remember when dealing with electrical equipment.
a. _____ b. _____ c. _____
2. If a piece of equipment is not grounded, it should still be operated.
True _____ False _____

Work Unit 3-2. FIRST AID TREATMENT

IDENTIFY THE FIRST AID PROCEDURES FOR TREATING AN ELECTRICAL SHOCK VICTIM.

Even after taking all possible safety precautions, there still is the possibility that an accident may occur. As a result, you should know what to do in case of electrical shock. Listed below are the procedures to follow should shock occur.

If an individual receives an electrical shock, you should turn off the electric power if possible. **DO NOT TOUCH THE INDIVIDUAL UNTIL CONTACT IS BROKEN.** If you cannot turn off the power, use a rope, wooden pole, or loop of dry cloth to pull the victim away. If breathing has stopped, restore the breathing as shown below.

Restoring the breathing. The following are the steps you should follow to restore breathing.

Turn victim on his back.

Wipe out victim's mouth quickly. Turn his head to the side. Use your fingers to get rid of mucus, food, sand, and other matter.

Straighten victim's head and tilt back so that chin points up (fig 3-3). Push or pull his jaw up into jutting out position to keep his tongue from blocking air passage (figs 3-4 and 3-5). This position is essential for keeping the air passage open throughout the procedure.

Place your mouth tightly over victim's mouth and pinch nostrils closed to prevent air leakage (fig 3-6). For a child, cover both nose and mouth tightly with your mouth. (Breathing through handkerchief or cloth placed over victim's mouth or nose will not greatly affect the exchange of air.)

Breathe into victim's mouth or nose until you see his chest rise. (Air may be blown through victim's teeth, even though they may be clenched.)

Remove your mouth and listen for the sound of returning air. If there is no exchange, recheck jaw and head position (figs 3-4 and 3-5). If you still do not get air exchange, turn victim on side and slap him on his back between the shoulder blades to dislodge matter that may be in the throat. Again, wipe his mouth to remove foreign matter.

Repeat breathing, removing mouth each time to allow the air to escape. For an adult, breathe about 12 times per minute. For a child, take relatively shallow breaths, about 20 per minute. Continue until victim breathes for himself.

Controlling bleeding. After insuring that the individual is breathing, you should then control bleeding which may have occurred. This can be done by pressing hard with a sterile compress directly over the wound until bleeding stops.

Treating for shock. After breathing is restored and bleeding is stopped, you should loosen constricting clothing to make the individual more comfortable. While doing this, you should continue to reassure the casualty. Remember, insure that the casualty stays warm, since any sudden change in body temperature may send the casualty into shock. You should always treat the victim for shock because most people will lapse into shock when they realize what has happened.

EXERCISE: Answer the following questions and check your responses against those listed at the end of this study unit.

1. When a person has been electrically shocked, you should immediately grab the person and pull him away.

True _____

False _____



Fig 3-3. Head position.



Fig 3-4. Pull jaw up.



Fig 3-5. Push jaw up.



Fig 3-6. Breathe.

2. If power cannot be turned off, you should use a rope, a wooden pole, or a loop of dry cloth to pull the victim away.

True _____

False _____

3. When performing rescue breathing, you should breathe about _____ times per minute for an adult.

a. 6

c. 18

b. 12

d. 24

4. After making sure that the victim is breathing, you should control

a. fire.

c. electrical wires.

b. bleeding.

d. breathing.

5. The casualty should be kept warm to help prevent

a. bleeding.

c. chills.

b. shock.

d. pneumonia.

SUMMARY REVIEW

In this study unit you have learned how to help prevent electrical shock from occurring. You have also become aware of the first aid procedures to follow, should electrical shock occur.

Answers to Study Unit #3 Exercises

Work Unit 3-1.

1. a. Assume all equipment is HOT
b. Insure equipment is grounded
c. Pay attention; "Don't Clown Around"
2. False

Work Unit 3-2.

1. False
2. True
3. b.
4. b.
5. b.

INSTALLATION, OPERATION, and OPERATOR'S MAINTENANCE
OF DIESEL-ENGINE-DRIVEN GENERATOR SETS

Review Lesson

Instructions: This review lesson is designed to aid you in preparing for your final exam. You should try to complete this lesson without the aid of reference materials, but if you do not know an answer, look it up and remember what it is. The enclosed answer sheet must be filled out according to the instructions on its reverse side and mailed to MCI using the envelope provided. The questions you miss will be listed with references on a feedback sheet (MCI-R69) which will be mailed to your commanding officer with your final exam. You should study the reference material for the questions you missed before taking the final exam.

- A. Multiple Choice: Select the ONE answer that BEST completes the statement or answers the question. After the corresponding number on the answer sheet, blacken the appropriate circle.

Value: 1 point each

1. The PU-708, -709, -710, and -711 are four of the generators that make up the 700 series. Which is another generator in the series?
 - a. 707
 - b. 712
 - c. 717
 - d. 724
2. What is the only difference between the PU-708 and PU-709 generator sets?
 - a. Oil
 - b. Frequency output
 - c. Voltage
 - d. Water
3. What is the only capability which remains the same in all five 700 series generators?
 - a. Voltage
 - b. Water capacity
 - c. Oil capacity
 - d. KW rating
4. How much more power can be provided with the 710 or 711 than with the 708 or 709?
 - a. 5 KW
 - b. 10 KW
 - c. 15 KW
 - d. 20 KW
5. When uncrating a 700 series generator set which procedure should be followed before the removal of crate and packing material?
 - a. Inspecting
 - b. Unloading
 - c. Locating
 - d. Positioning
6. When removing the generator from its carrier, you should use a forklift that is at least _____ the weight of the generator set.
 - a. double
 - b. three times
 - c. equal
 - d. one half
7. When moving the generator a short distance, you should use a forklift or
 - a. helicopter.
 - b. 10 Marines.
 - c. 20 Marines.
 - d. overhead crane.
8. When using a forklift to move a generator, the forks are inserted into the openings of the skid base assembly and moved forward until the generator is
 - a. 6" from frame of forklift.
 - b. 3" from frame of forklift.
 - c. in contact with frame of forklift.
 - d. 2" from frame of forklift.

9. Which part of the crane should be engaged in the lifting eye of the generator when moving a 700 series generator?
 - a. Lifting hook
 - b. Towing hook
 - c. Cable
 - d. Hook arm
10. During the initial servicing of a 700 series generator you should close/open drain cocks, fill the fuel tank, activate the batteries, add engine coolant, and
 - a. lubricate the engine.
 - b. test indicator lights.
 - c. mount generator.
 - d. check voltage change over board.
11. When choosing a proper site for a 700 series generator, you should look for an area which is clear of obstacles, is well ventilated, and is
 - a. at least 50 feet from a paralleled generator.
 - b. close to the nearest oil source.
 - c. level ground.
 - d. higher than surrounding area.
12. The three factors to consider when positioning a generator set are the needs of the user, terrain conditions, and
 - a. tactical situation.
 - b. length of remote control cable.
 - c. closeness to CO's tent.
 - d. distance to fuel supply.
13. When siting a generator on unlevel terrain, you must insure that the angle of slope or tilt does not exceed _____ degrees from level.
 - a. 3
 - b. 5
 - c. 10
 - d. 15
14. The maximum distance a 700 series generator should be placed from a paralleled generator is _____ feet.
 - a. 15
 - b. 20
 - c. 25
 - d. 50
15. Which is the maximum distance you should locate a 700 series generator from the auxiliary fuel source?
 - a. 5 feet
 - b. 15 feet
 - c. 20 feet
 - d. 24 feet
16. Which is the maximum distance you should locate a 700 series generator from the remote control panel?
 - a. 25 feet
 - b. 50 feet
 - c. 75 feet
 - d. 100 feet
17. You should always ground your generator set to avoid equipment damage and to avoid
 - a. over-voltage.
 - b. electrical shock.
 - c. current surge.
 - d. excessive exhaust fumes.
18. The ground rod is driven into the ground until the top is approximately _____ inches above ground.
 - a. 2
 - b. 3
 - c. 4
 - d. 5

- B. Matching: In the group of items below (items 19 to 23), match the function of the indicators in column 1 with the proper indicator in column 2. For each item select one letter (a, b, c, d, or e) indicating your choice and mark it on your answer sheet.

Column 1

Functions

19. Indicates line-to-line and line-to-neutral voltages
20. Activates load contactor
21. Indicates the frequency of the voltage in hertz (Hz)
22. Permits resetting of any faults
23. Initiates shutdown in case of emergency

Column 2

Indicators

- a. Frequency meter
- b. Emergency shutdown switch
- c. Voltmeter
- d. Fault reset switch
- e. Load contactor switch

- C. Multiple Choice: Select the ONE answer which BEST completes the statement or answers the question. After the corresponding number on the answer sheet, blacken the appropriate circle.

Value: 1 point each

24. The area around the generator set should be kept dry to prevent

- | | |
|--------------|-------------|
| a. flooding. | c. sinking. |
| b. shock. | d. mud. |

25. When filling the fuel tank of 700 series and DOD series generator set, always maintain metal to metal contact to prevent

- | | |
|--------------|-------------------|
| a. sparking. | c. overflow. |
| b. spillage. | d. contamination. |

26. Before you connect the load cables, you should make sure the generator is not connected in parallel to another set that is running and that the

- | | |
|--|--------------------------------------|
| a. load contactor is reset. | c. protection bypassed switch is on. |
| b. all switches are in the off position. | d. ventilating louvers are closed. |

27. Prior to starting the generator, which should you inspect to avoid electrical shock or malfunctions in equipment?

- | | |
|----------------------|----------------|
| a. Ground connection | c. Fuel supply |
| b. Water level | d. Oil level |

28. Before operating the 700 series generators in an enclosed area, you should take precautions to avoid safety problems caused by

- | | |
|----------------------|-------------------|
| a. high noise level. | c. poor lighting. |
| b. spillage. | d. exhaust fumes. |

- D. Matching: In the group of items below (items 29-32), match the terminal number in column 1 with the proper phase connection in column 2. For each item select one letter (a, b, c, d, or e) indicating your choice and mark it on your answer sheet.

Value: 1 point each

Column 1

Column 2

Terminal

Phase connection

29. L1

a. Neutral

30. L2

b. A

31. L3

c. C

d. B

32. L0

e. E

- E. Multiple Choice: Select the ONE answer which BEST completes the statement or answers the question. After the corresponding number on the answer sheet, blacken the appropriate circle.

Value: 1 point each

33. When performing the prestart inspection of a 700 series generator, you should use NAVMC form 10523 or NAVMC

a. 10522.

c. 10524.

b. 10253.

d. 10425.

34. The three procedures for operating the generator set are: starting, monitoring, and

a. contacting load.

c. maintenance.

b. refueling.

d. shutting down.

- F. Matching: In the group of items below (items 35-38), match the operating steps in column 1 with the correct procedure in column 2. For each item select one letter (a, b, or c) indicating your choice and mark it on your answer sheet.

Value: 1 point each

Column 1

Column 2

Operating steps

Procedures

35. Operate generator 2-5 minutes before stopping.

a. Starting

b. Monitoring

36. Turn frequency and voltage rheostats counterclockwise.

c. Shutting down

37. Inspect for unusual noises, overheating, oil leakage.

38. Check for illumination of indicator lights.

- Matching: In the group of items below (items 39-42), match the unusual operating condition in column 1 with a specific operating procedure in column 2. For each item select one letter (a, b, c, d, or e) indicating your choice and mark it on your answer sheet.

Value: 1 point each

Column 1

Column 2

Unusual operating conditionsOperating procedure

- | | |
|--|---|
| 39. Saltwater areas and humid conditions | a. Check coolant level daily and add clean, fresh water as necessary. |
| 40. Dusty or sandy areas | b. Turn the protection bypassed switch to ON. |
| 41. Extreme heat | c. Keep the generator set well lubricated. |
| 42. Emergency conditions | d. Wet down surrounding terrain beyond immediate operating area. |
| | e. Add saltwater to cooling system. |

G. Multiple Choice: Select the ONE answer which BEST completes the statement or answers the question. After the corresponding number on the answer sheet, blacken the appropriate circle.

Value: 1 point each

43. The operator is authorized to perform _____ echelon only.
- | | |
|----------------|--------|
| a. limited 3rd | c. 2nd |
| b. 3rd | d. 1st |
44. The five items you are required to perform during the operator's maintenance of 700 series generators are inspecting, cleaning, servicing, lubricating, and
- | | |
|------------------|----------------|
| a. transporting. | c. operating. |
| b. adjusting. | d. supporting. |
45. When performing operator's maintenance on the 700 series generator, the two records used are the NAVMC 10523 and the NAVMC
- | | |
|-----------|-----------|
| a. 10524. | c. 10423. |
| b. 10525. | d. 10425. |
46. Which NAVMC form provides the operator with the authority to operate an item of equipment (700 series generator) on an assigned mission?
- | | |
|----------|----------|
| a. 10523 | c. 10525 |
| b. 10524 | d. 10526 |
47. Which NAVMC form gives the operator authority to operate a 700 series generator set for extended periods of time?
- | | |
|----------|----------|
| a. 10526 | c. 10524 |
| b. 10525 | d. 10523 |
48. The four generator sets that make up the DOD series include the MEP 005a, the MEP 006a, the MEP 007a, and the MEP
- | | |
|-----------|----------|
| a. 0011a. | c. 009a. |
| b. 0010a. | d. 003a. |
49. DOD series generators have common frequency output capabilities of 50/60 Hz and voltage output capabilities of
- | | |
|-------------|-------------|
| a. 110/208. | c. 130/208. |
| b. 120/208. | d. 140/208. |

- H. Matching: In the group of items below (items 50-53), match the DOD generator in column 1 with the appropriate KW rating in column 2. For each item select one letter (a, b, c, d, or e) indicating your choice and mark it on your answer sheet.

Value: 1 point each

Column 1	Column 2
<u>DOD generators</u>	<u>KW rating</u>
50. MEP-005a	a. 30 KW
51. MEP-006a	b. 40 KW
52. MEP-007a	c. 60 KW
53. MEP-008a	d. 100 KW
	e. 200 KW

- I. Multiple Choice: Select the ONE answer which BEST completes the statement or answers the question. After the corresponding number on the answer sheet, blacken the appropriate circle.

Value: 1 point each

54. The two steps in the procedure for uncrating the DOD generator sets are unloading and
- arranging for a crane.
 - briefing the crane driver.
 - removal of the crate.
 - initial servicing.
55. The two pieces of equipment that can be used to unload or move DOD generator sets are the crane and
- hydraulic jack.
 - man power.
 - forklift.
56. The crane or forklift must be rated for at least _____ pounds to safely move the DOD generator.
- 5,000
 - 8,000
 - 10,000
 - 15,000
57. When uncrating a DOD generator which procedure should be done after the removal of the top of the crate?
- Remove the bottom.
 - Remove the sides.
 - Position the crate.
 - Unload the crate.
58. When uncrating a DOD series generator for temporary use, the skid base remains attached. What should be done with the base if the generator is to be installed permanently?
- The base remains bolted to generator.
 - The base is removed from generator.
 - The base is equipped with lifting eyes.
 - The base is removed only if located on unlevel ground.
59. When using a forklift to move a DOD generator the forks are placed
- under the skid base assembly.
 - through the openings in the skid base assembly.
 - on the skid base assembly to push the generator.
 - through the lifting rings on top of the generator.

60. When moving a DOD generator with a crane, the generator is lifted by the
- holes in skid base assembly.
 - towing rings at both ends of generator.
 - lifting eyes.
 - lifting eye on top of motor.
61. The three steps in servicing the radiator for the DOD generator are opening radiator access door and removing radiator cap, filling radiator with coolant _____ inches below filler mark, and fastening tag indicating type of coolant and level of protection.
- 2
 - 4
 - 6
 - 8
62. Two steps in the servicing of the crankcase are removing the filler cap to add oil to full mark and
- replacing the oil filter.
 - replacing the oil pan gasket.
 - checking for oil leaks.
 - checking the crankcase oil level.
63. The two steps in servicing the fuel tank are removing the fuel tank cap and filling the fuel tank, replacing the cap and
- checking for fuel leaks.
 - wiping up spilled fuel.
 - checking to see if fuel gage reads full.
 - logging gallons used on NAVMC 10523.
64. During initial servicing of the batteries of a DOD generator fill the battery cells to the _____ in the cells, than replace caps and rinse off with fresh water.
- top of plates
 - bottom of plates
 - line
 - slots
65. When locating the DOD generator, keep it as level as possible, clear of obstacles, and with ample
- fuel.
 - water.
 - ventilation.
 - oil.
66. The maximum distance a DOD generator should be placed from a paralleled generator is _____ feet.
- 30
 - 25
 - 20
 - 15
67. What is the greatest distance you should locate a DOD generator from a remote control site?
- 200 feet
 - 350 feet
 - 500 feet
 - 750 feet
68. The greatest distance you should locate a DOD generator from an auxiliary fuel supply is _____ feet.
- 20
 - 25
 - 30
 - 35

69. Two key factors to consider when positioning a DOD generator for permanent installation are insuring the base is solid enough to support the weight of the unit and insuring that
- it is centrally located.
 - drainage is good.
 - there is sufficient space for servicing and operation.
 - there is easy access for fuel truck.
70. Which is a key factor to remember when positioning a DOD generator for temporary installation?
- Place in central location.
 - Place as close to worksite as possible.**
 - Insure that there is easy access for fuel truck.
 - Locate within 500 feet of an auxiliary fuel supply.
71. When positioning a DOD generator indoors, you must install a gas-tight exhaust line to the outside for ventilation. This line should be _____ inches I. D.
- 2
 - 4
 - 6
 - 8
72. In order of preference, the three acceptable grounding devices are a metallic water pipe, a grounding rod, and a(n)
- buried metal plate.
 - bulk fuel line.
 - paralleled generator.
 - LO terminal of the generator.
73. The minimum diameter requirements for a grounding rod are 5/8 inch if solid and _____ inch if hollow.
- 1/2
 - 5/8
 - 3/4
 - 1
74. To meet minimum requirements for a ground rod to be used for a DOD generator, it should be driven to a depth of _____ feet.
- 2
 - 4
 - 6
 - 8
75. A ground plate must have an area of at least nine square feet and must be buried to a minimum depth of
- 1 foot.
 - 2 feet.
 - 3 feet.
 - 4 feet.
76. When grounding the generator, the ground wire must be at least a
- #4 AWG.
 - #6 AWG.
 - #8 AWG.
 - #10 AWG.

- J. Matching: In the group of items below (items 77 to 81), match the functions of the indicators in column 1 with the proper control, instrument, or receptacle in column 2. For each item select one letter (a, b, c, d, or e) indicating your choice.

Column 1

Column 2

Functions

Controls, indicators, or receptacles

77. Permits manual shutdown of engine
78. Permits resetting of engine overspeed
79. Initiates start sequence
80. Indicates operating time in hours
81. Indicates generator electrical power output

- a. Kilowatt meter
b. Manual fuel shutdown lever
c. Running time meter
d. Start, run, stop switch
e. Speed switch reset button

- K. Multiple Choice: Select the ONE answer that BEST completes the statement or answers the question. After the corresponding number on the answer sheet, blacken the appropriate circle.

Value: 1 point each

82. To prevent electrical shock, the operating area should be insulated and kept
a. elevated. c. dry.
b. covered. d. concealed.
83. When filling the fuel tank of a DOD generator during initial servicing, you should follow which safety precaution to prevent sparking?
a. Avoid overflow b. Avoid stoppages c. Keep metal to metal contact
84. The DOD generator set should be turned off and not in parallel with another generator, and all switches should be in open or off position before connecting the
a. fuel cable. c. water cable.
b. oil cable. d. power cable.
85. Prior to starting a DOD series generator, which should you inspect to avoid electrical shock and damage to the equipment?
a. Fuel supply c. Water level
b. Ground connection d. Oil level
86. You should pipe exhaust gases outside if operating in an enclosed area and stay clear of all electrical terminals. Which should not be injected into the engine-manifold unless the engine is being cranked?
a. Fuel c. Cleaning solvent
b. Ether d. Oil

- L. Matching: In the group of items below (items 87-90), match the terminal number in column 1 with the proper phase connection in column 2. For each item select one letter (a, b, c, d, or e) indicating your choice and mark it on your answer sheet.

Value: 1 point each

Column 1	Column 2
<u>Terminal</u>	<u>Phase connection</u>
87. L1	a. Neutral
88. L2	b. d
89. L3	c. c
	d. b
	e. a
90. L0	

- M. Multiple Choice: Select the ONE answer that BEST completes the statement or answers the question. After the corresponding number on the answer sheet, blacken the appropriate circle.

Value: 1 point each

91. When performing the prestart inspection of a DOD generator, you should use the NAVMC 10523 or the NAVMC
- | | |
|-----------|-----------|
| a. 10522. | c. 10524. |
| b. 10253. | d. 10425. |
92. Procedures to be followed when operating DOD generator sets include starting, _____, and shutting down.
- | | |
|---------------|---------------|
| a. servicing | c. cleaning |
| b. inspecting | d. monitoring |

- N. Matching: In the group of items below (items 93-96), match the operating steps in column 1 with the correct procedure in column 2. For each item select one letter (a, b, or c) indicating your choice and mark it on your answer sheet.

Value: 1 point each

Column 1	Column 2
<u>Operating steps</u>	<u>Procedure</u>
93. Perform after operations check	a. Starting
94. Inspect controls and indicators for proper operation	b. Running
95. Inspect load cables for security and proper connection	c. Shutting down
96. Inspect engine air box, drain cocks to make sure they are in the full open position	

- O. Multiple Choice: Select the ONE answer that BEST completes the statement or answers the question. After the corresponding number on the answer sheet blacken the appropriate circle.

Value: 1 point each

97. Which is true of areas where unusual conditions such as extreme heat and cold, dust or sand, snow, high altitudes, rain, battle short, and salt water are found?
- a. Generator should NOT be operated
 - b. Generator can be operated with special precautions
 - c. Generator may be operated as usual
98. When operating in extreme cold, if water is added to the batteries, the generator should be run for at least _____ hour(s).
- a. 1
 - b. 2
 - c. 3
 - d. 4
99. When operating in extreme heat, you should allow the engine to run at least _____ minutes after removal of load.
- a. 3
 - b. 5
 - c. 7
 - d. 9
100. The fuel filters and strainers should be serviced more frequently when operating in sandy or _____ areas.
- a. windy
 - b. dusty
 - c. wet
 - d. dry
101. You should keep the fuel tank full to prevent condensation when operating a DOD generator in rainy conditions or in _____.
- a. extreme heat.
 - b. high winds.
 - c. sandy conditions.
 - d. extreme cold.
102. The five items of operator's maintenance include inspection, cleaning, servicing, adjustments, and _____.
- a. repair.
 - b. limited repair.
 - c. lubricating.
 - d. replacing.
103. The three systematic inspections to be performed on DOD generator sets are before operation, during operation, and _____ operation.
- a. battle short.
 - b. pre-shipment.
 - c. post-shipment.
 - d. after.
104. The two forms used by the operator while operating a DOD generator are the NAVMC 10524 and the NAVMC _____.
- a. 10523.
 - b. 10525.
 - c. 10526.
 - d. 10527.
105. While operating a DOD generator, which NAVMC form provides the operator with authority to operate an item of equipment on an assigned mission?
- a. 10526
 - b. 10525
 - c. 10524
 - d. 10523

106. Which NAVMC form provides the operator with the authority to operate a DOD generator set for extended periods of time?
- a. 10523
 - b. 10524
 - c. 10525
 - d. 10526
107. Three means by which you can avoid electrical shock are to assume all equipment is hot, to insure all equipment is grounded, and to
- a. turn off all equipment.
 - b. not smoke near equipment.
 - c. pay attention, don't clown around.
 - d. stay away from equipment.
108. Prior to starting a generator, you should assure that it is
- a. painted.
 - b. turned off.
 - c. grounded.
 - d. camouflaged.
109. When working on a piece of electrical equipment, always assume it is
- a. hot.
 - b. turned off.
 - c. broken.
 - d. grounded.
110. The first aid procedures for treating an electrical shock victim are maintain breathing, control bleeding, loosen constrictive clothing, reassure casualty, and
- a. stop equipment.
 - b. administer painkiller.
 - c. keep victim warm.
 - d. fan face.
111. When performing rescue breathing on an adult, you should breathe _____ times a minute.
- a. 12
 - b. 18
 - c. 24
 - d. 30
112. The casualty should be kept warm to help prevent
- a. chills.
 - b. pneumonia.
 - c. bleeding.
 - d. shock.
113. After an electrical shock has occurred the victim should be pulled clear by using a wooden pole, a loop of dry cloth, or a
- a. hand.
 - b. rope.
 - c. metal pole.
114. If breathing has stopped due to electrical shock, you should first
- a. start rescue breathing.
 - b. stop the bleeding.
 - c. call for help.
 - d. treat for shock.

Total Points: 114